RESUSCITATION 2009

Veranstaltung des GRC / GRC Meeting

Freitag, 2. Oktober / Friday 2 October

CPR-Techniken und Geräte	**M. Baubin, M. Holzer**
Neue Defibrillatoren	M. Baubin
Mechanische Reanimationssysteme	M. Fischer
Reanimation und Kühlen	W. Schreiber
Reanimation mittels invasiver Techniken	M. Arlt

RESUSCITATION 2009
COLOGNE - GERMANY
OCTOBER 2 - 3

RESUSCITATION 2009

COLOGNE - GERMANY

Mechanische Reanimationssysteme

Matthias Fischer

Klinik für Anästhesiologie, Operative Intensivmedizin und Schmerztherapie der Klinik am Eichert, Göppingen

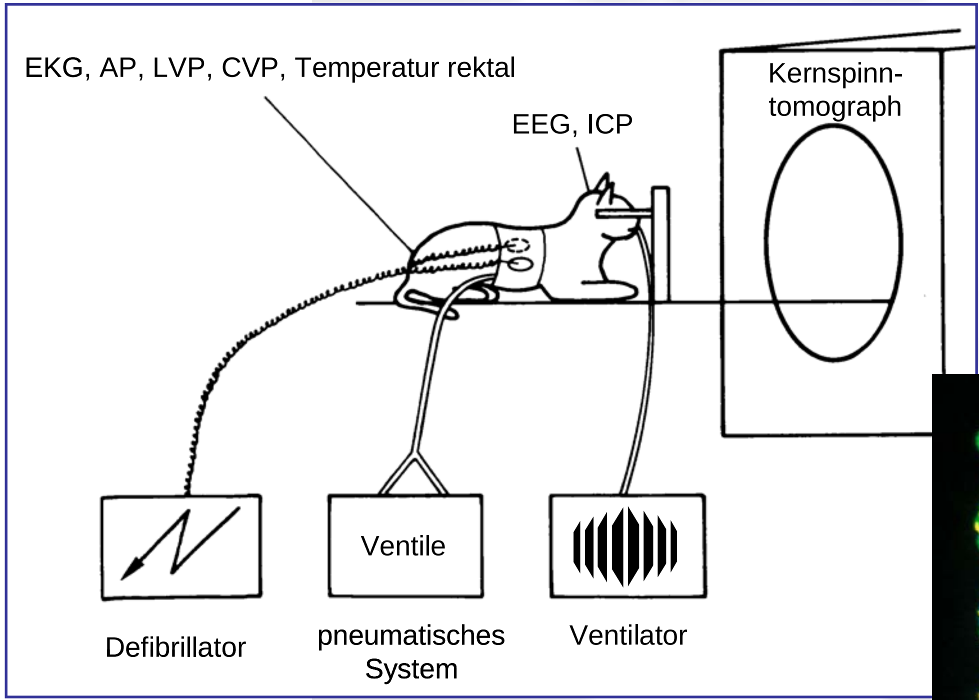
Conflict of interest

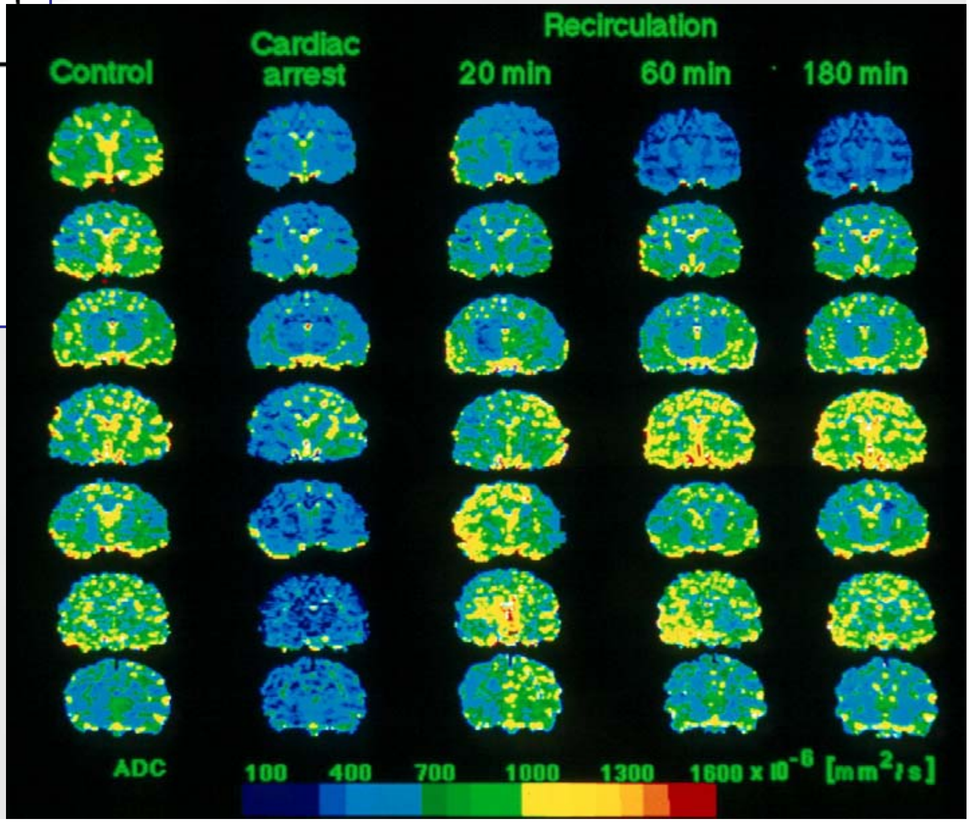
- I am the Principal Investigator of the „Hypertonic saline during CPR" trial, an investigator initiated trial, which was sponsored by Fresenius Medical Care. I do not receive any honorarium for this.

- I am the Principal Investigator of a trial „AutoPulse® CPR after OHCA", testing mechanical CPR in the emergency physicians based EMS systems in Bonn, Ulm and Göppingen. It is an investigator initiated trial, which is sponsored by ZOLL. I do not receive any honorarium for this.

- I am member of the steering committees of the EED-Project and the SIDARTHa-Project, which received funding by the European Community under the EU Health Monitoring Program.

Herz-Kreislaufstillstand, experimentell Westen-CPR





„ferngesteuerte" CPR
im MRT-Scanner 4,7 Teslar

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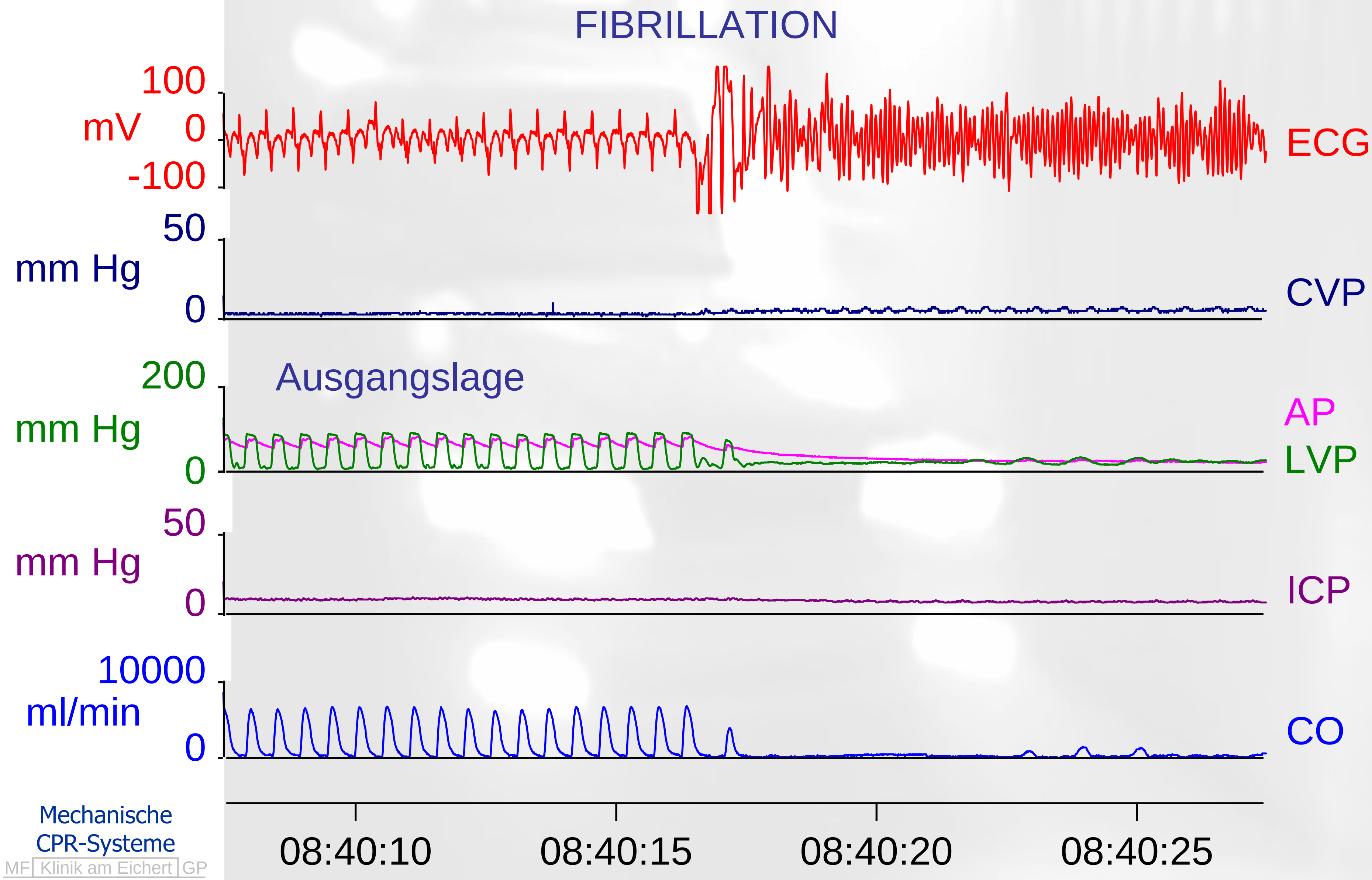
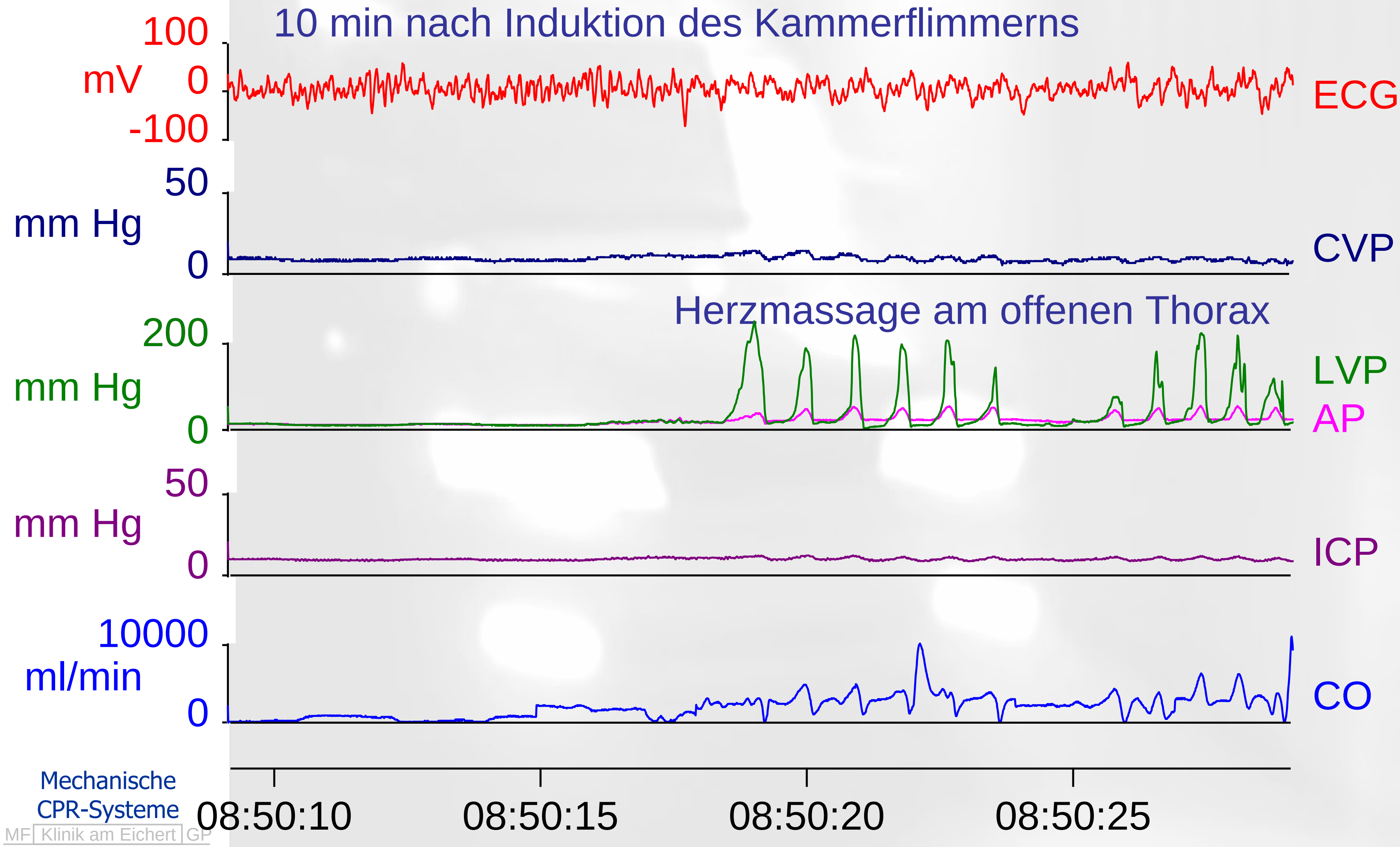
Herz-Kreislaufstillstand, experimentell

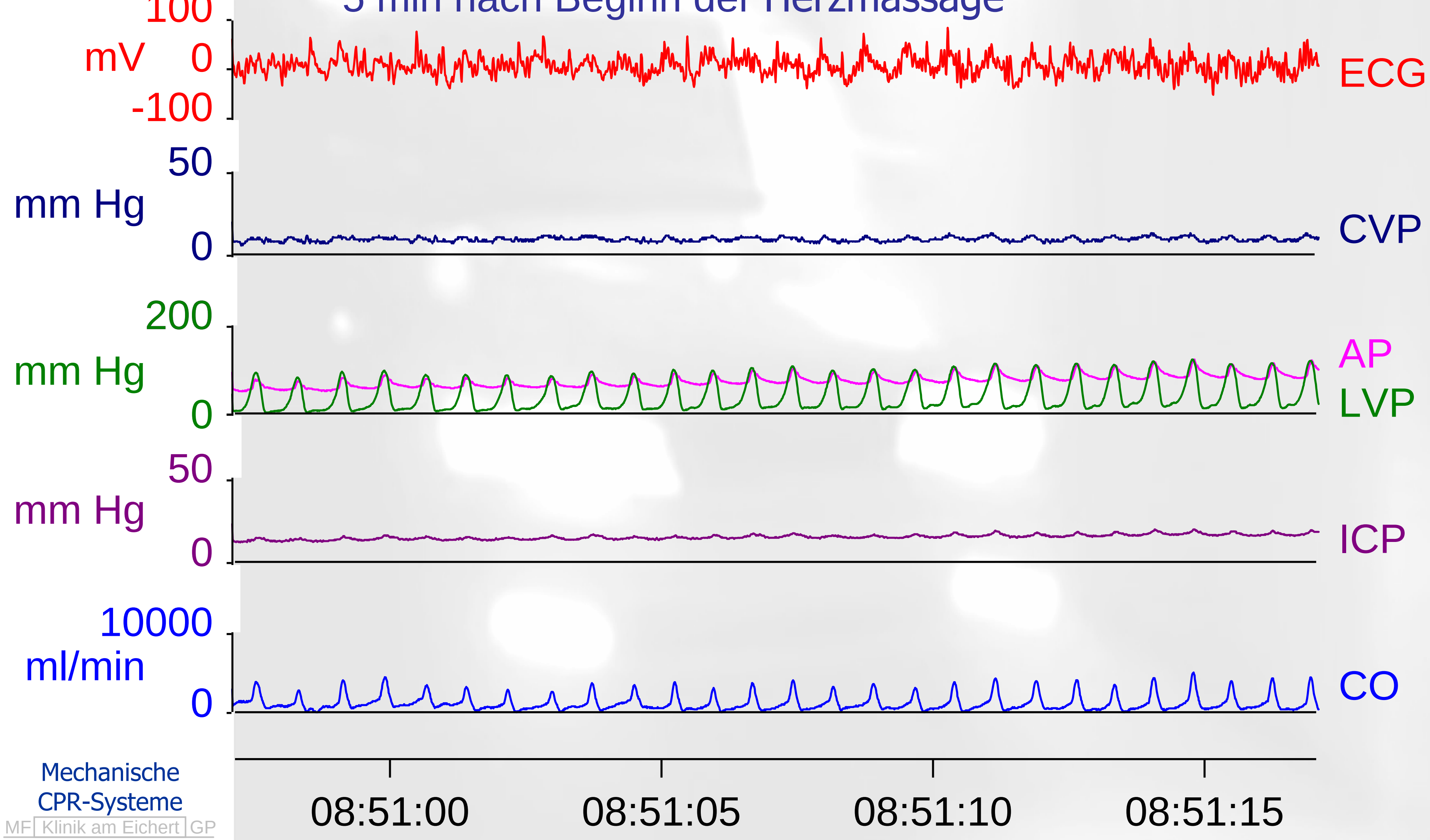


Herz-Kreislaufstillstand, experimentell direkte Herzmassage

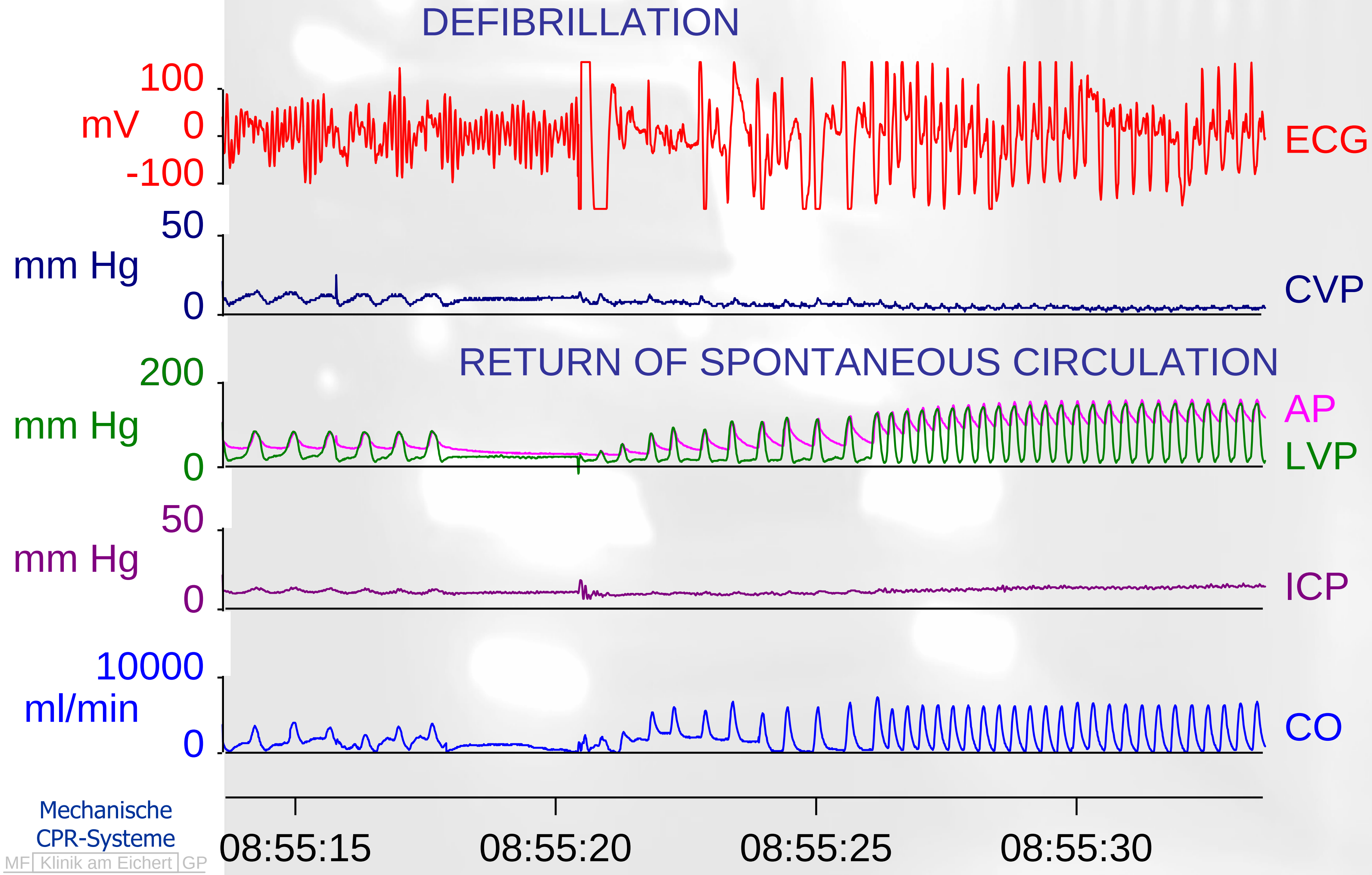


Herz-Kreislaufstillstand, experimentell direkte Herzmassage

5 min nach Beginn der Herzmassage

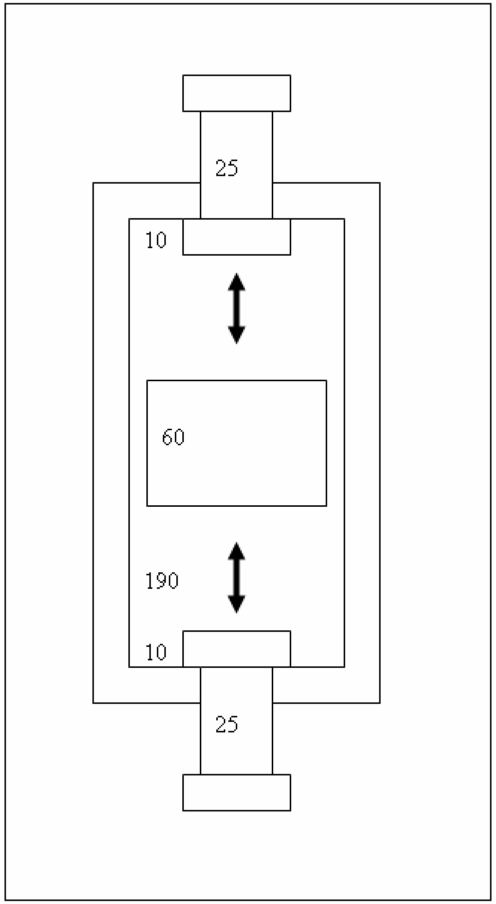


Herz-Kreislaufstillstand, experimentell



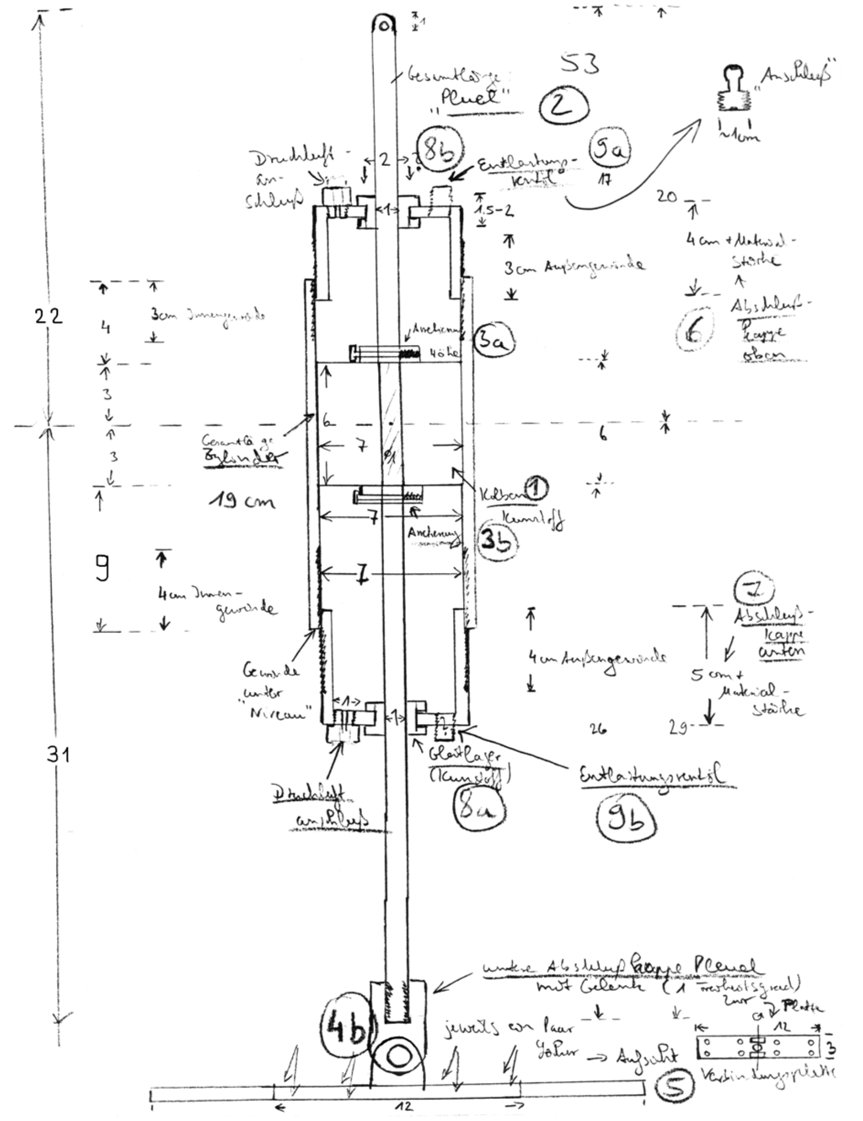
Mechanische CPR-Systeme

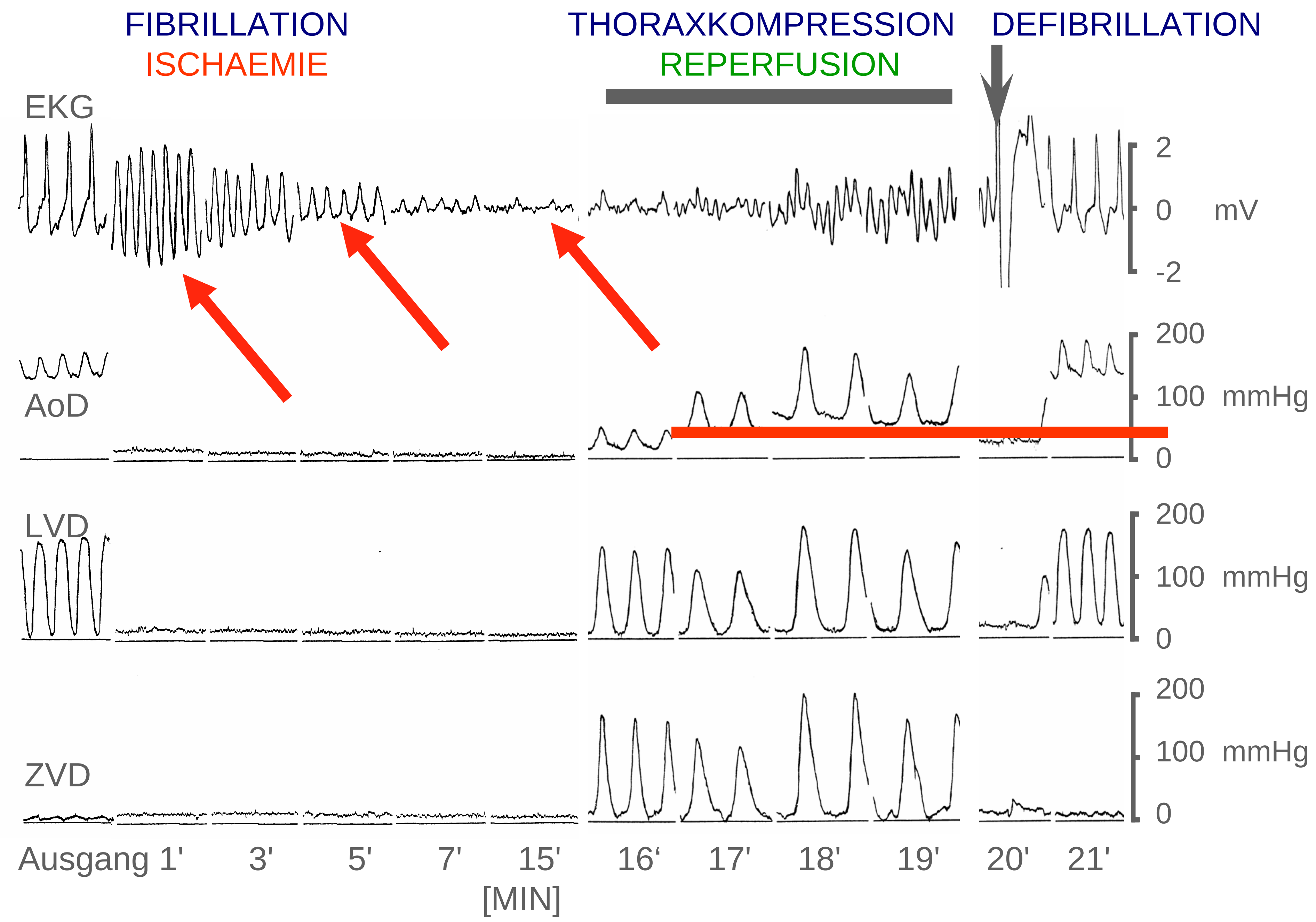
Herz-Kreislaufstillstand, experimentell ACD-CPR



Schnittschema des Gerätes:

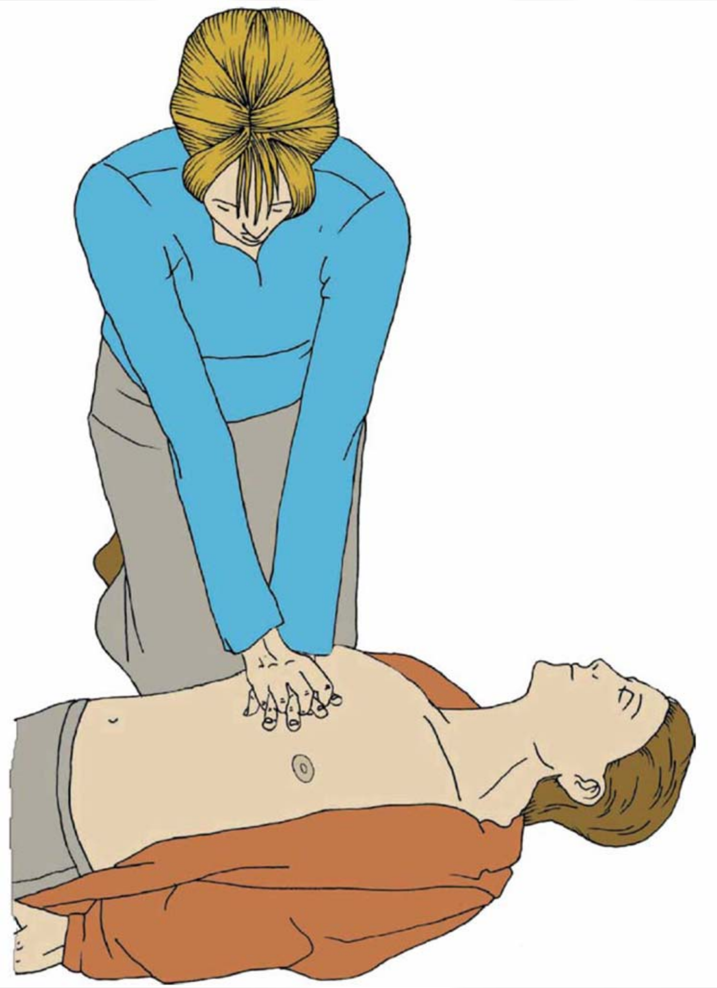
maximaler Weg 110 mm, minimaler Weg 60 mm, minimaler Weg mit eingelegten Distanzscheiben (2 x 10 mm und 2 x 5 mm) 30 mm
(Werte in mm)

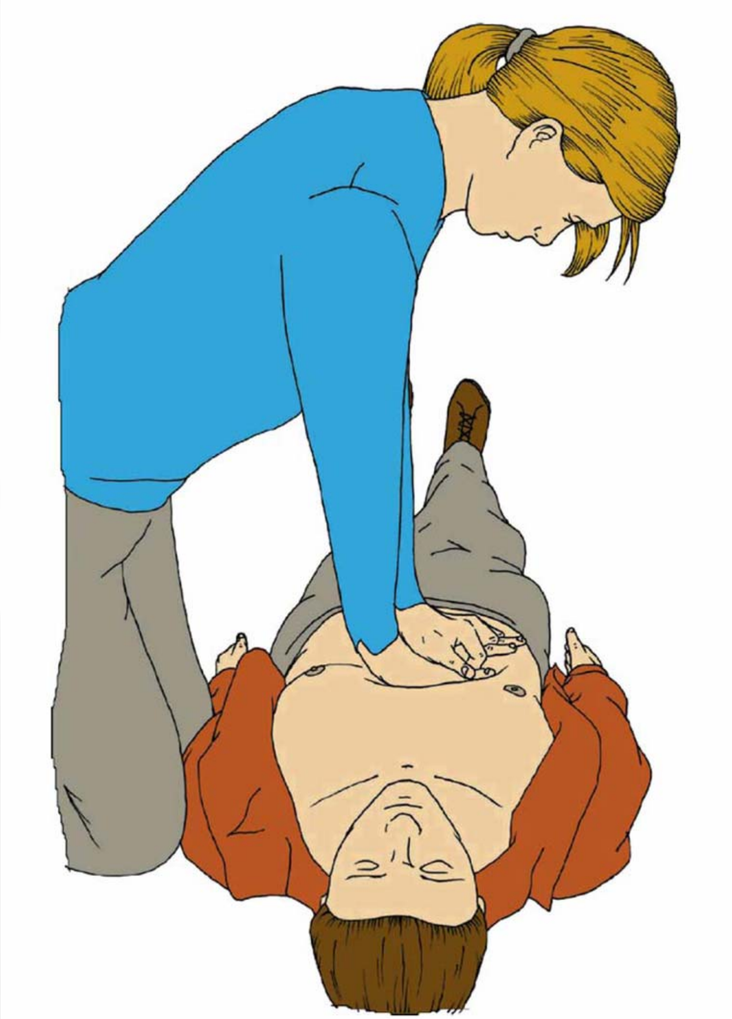




FIBRILLATION
ISCHAEMIE
THORAXKOMPRESSION
REPERFUSION
DEFIBRILLATION
EKG
2
0
-2
mV
AoD
200
100 mmHg
0
LVD
200
100 mmHg
0
ZVD
200
100 mmHg
0
Ausgang 1'
3'
5'
7'
15'
16'
17'
18'
19'
20'
21'
[MIN]

Basismaßnahmen Erwachsene (ERC)





Finger verschränken, Sternum 4-5 cm niederdrücken
100 mal pro Minute

ERC Guidelines for CPR, Resuscitation 2005

CPR Qualität bei Profis

ORIGINAL CONTRIBUTION

Quality of Cardiopulmonary Resuscitation During In-Hospital Cardiac Arrest

Benjamin S. Abella, MD, MPhil
Jason P. Alvarado, BA
Helge Myklebust, BEng
Dana P. Edelson, MD
Anne Barry, RN, MBA
Nicholas O'Hearn, RN, MSN
Terry L. Vanden Hoek, MD
Lance B. Becker, MD

Context The survival benefit of well-performed cardiopulmonary resuscitation (CPR) is well-documented, but little objective data exist regarding actual CPR quality during cardiac arrest. Recent studies have challenged the notion that CPR is uniformly performed according to established international guidelines.

Objectives To measure multiple parameters of in-hospital CPR quality and to determine compliance with published American Heart Association and international guidelines.

Design and Setting A prospective observational study of 67 patients who experienced in-hospital cardiac arrest at the University of Chicago Hospitals, Chicago, Ill, between December 11, 2002, and April 5, 2004. Using a monitor/defibrillator with novel additional sensing capabilities, the parameters of CPR quality including chest compression rate, compression depth, ventilation rate, and the fraction of arrest time without chest compressions (no-flow fraction) were recorded.

Main Outcome Measure Adherence to American Heart Association and international CPR guidelines.

Results Analysis of the first 5 minutes of each resuscitation by 30-second segments revealed that chest compression rates were less than 90/min in 28.1% of segments. Compression depth was too shallow (defined as <38 mm) for 37.4% of compressions. Ventilation rates were high, with 60.9% of segments containing a rate of more than 20/min. Additionally, the mean (SD) no-flow fraction was 0.24 (0.18). A 10-second pause each minute of arrest would yield a no-flow fraction of 0.17. A total of 27 patients (40.3%) achieved return of spontaneous circulation and 7 (10.4%) were discharged from the hospital.

Conclusions In this study of in-hospital cardiac arrest, the quality of multiple parameters of CPR was inconsistent and often did not meet published guideline recommendations, even when performed by well-trained hospital staff. The importance of high-quality CPR suggests the need for rescuer feedback and monitoring of CPR quality during resuscitation efforts.

JAMA. 2005;293:305-310 www.jama.com

SURVIVAL FROM CARDIAC ARREST remains low despite the introduction of cardiopulmonary resuscitation (CPR) more than 50 years ago.[1-3] The delivery of CPR, with correctly performed chest compressions and ventilations, exerts a significant survival benefit in both animal and human studies.[4-8] Conversely, interruptions in CPR or failure to provide compressions during cardiac arrest ("no-flow time") have been noted to have a negative impact on survival in animal studies.[7] Consensus guidelines clearly define how CPR is to be performed,[9] but the parameters of CPR in actual practice are not routinely measured, nor is the quality known.

There are multiple reasons for concern regarding the quality of CPR. Even though CPR training programs are ubiquitous, a number of studies demonstrate that these learned resuscitation skills deteriorate over time.[10,11] Furthermore, issues such as translation of skills from training environments to actual cardiac arrest settings, as well as rescuer fatigue during resuscitation,[12] may limit CPR quality. Recent investigations have revealed that patients may be hyperventilated during out-of-hospital arrest,[13] and that low chest compression rates are present during in-hospital arrest.[14,15]

Given the proven survival benefit of high-quality CPR and the lack of data on actual performance, we sought to determine whether well-trained hospital staff perform CPR compressions and ventilations according to guideline recommendations. The in-hospital environment was selected because it offers the added advantage of thorough prearrest documentation as well as resus-

See also pp 299 and 363 and Patient Page.

Author Affiliations: Sections of Emergency Medicine (Drs Abella, Edelson, Vanden Hoek, and Becker, and Mr Alvarado and Ms Barry) and Critical Care (Mr O'Hearn), University of Chicago Hospitals, Chicago, Ill; and Laerdal Medical Corporation, Stavanger, Norway (Mr Myklebust).

Financial Disclosures: Mr Myklebust is an employee of Laerdal Medical Corporation, which developed the monitor/defibrillator. Dr Becker has received grant/research support from Philips Medical Systems, Laerdal Medical Corp, and Alsius Corp, and has served as a consultant for Abbott Laboratories and Philips Medical Systems.

Corresponding Author: Lance B. Becker, MD, University of Chicago Hospitals, Section of Emergency Medicine, 5841 S Maryland Ave, MC 5068, Chicago, IL 60637 (lbecker@medicine.bsd.uchicago.edu).

ORIGINAL CONTRIBUTION

Quality of Cardiopulmonary Resuscitation During Out-of-Hospital Cardiac Arrest

Lars Wik, MD, PhD
Jo Kramer-Johansen, MD
Helge Myklebust, BEng
Hallstein Sorebo, MD
Leif Svensson, MD
Bob Fellows, MD
Petter Andreas Steen, MD, PhD

Context Cardiopulmonary resuscitation (CPR) guidelines recommend target values for compressions, ventilations, and CPR-free intervals allowed for rhythm analysis and defibrillation. There is little information on adherence to these guidelines during advanced cardiac life support in the field.

Objective To measure the quality of out-of-hospital CPR performed by ambulance personnel, as measured by adherence to CPR guidelines.

Design and Setting Case series of 176 adult patients with out-of-hospital cardiac arrest treated by paramedics and nurse anesthetists in Stockholm, Sweden, London, England, and Akershus, Norway, between March 2002 and October 2003. The defibrillators recorded chest compressions via a sternal pad fitted with an accelerometer and ventilations by changes in thoracic impedance between the defibrillator pads, in addition to standard event and electrocardiographic recordings.

Main Outcome Measure Adherence to international guidelines for CPR.

Results Chest compressions were not given 48% (95% CI, 45%-51%) of the time without spontaneous circulation; this percentage was 38% (95% CI, 36%-41%) when subtracting the time necessary for electrocardiographic analysis and defibrillation. Combining these data with a mean compression rate of 121/min (95% CI, 118-124/min) when compressions were given resulted in a mean compression rate of 64/min (95% CI, 61-67/min). Mean compression depth was 34 mm (95% CI, 33-35 mm), 28% (95% CI, 24%-32%) of the compressions had a depth of 38 mm to 51 mm (guidelines recommendation), and the compression part of the duty cycle was 42% (95% CI, 41%-42%). A mean of 11 (95% CI, 11-12) ventilations were given per minute. Sixty-one patients (35%) had return of spontaneous circulation, and 5 of 6 patients discharged alive from the hospital had normal neurological outcomes.

Conclusions In this study of CPR during out-of-hospital cardiac arrest, chest compressions were not delivered half of the time, and most compressions were too shallow. Electrocardiographic analysis and defibrillation accounted for only small parts of intervals without chest compressions.

JAMA. 2005;293:299-304 www.jama.com

SINCE THE FIRST STANDARDS AND guidelines for cardiopulmonary resuscitation (CPR) were published 30 years ago[1] (with the latest update in 2000[2,3]) health care professionals in and out of the hospital have been trained accordingly around the world. The importance of CPR, defined as chest compressions and ventilation, for survival of cardiac arrest patients has been demonstrated,[4] and there are indications that the quality of CPR performance influences the outcome.[5-7]

When tested on mannequins, CPR quality performed by lay rescuers and health care professionals tends to deteriorate significantly within a few months after training,[8-10] but little is known about the quality of clinical performance on patients. Aufderheide et al[11] recently observed short periods with inappropriately high ventilation rates during advanced cardiac life support (ACLS), and van Alem et al[12] found long pauses in CPR when first responders used automated external defibrillators.

We therefore studied the performance of paramedics and nurse anesthetists during out-of-hospital ACLS by continuously monitoring all chest compressions and ventilations during resuscitation episodes using online defibrillators modified to collect such data.

METHODS

Patient Inclusion and Recruitment

The study was approved by the regional ethics committees for Akershus, Norway, Stockholm, Sweden, and London, England. Informed consent for inclusion in the study was waived as decided by these committees in accordance with paragraph 26 in the Declaration of Helsinki.[13] The study was a case series involving patients older than

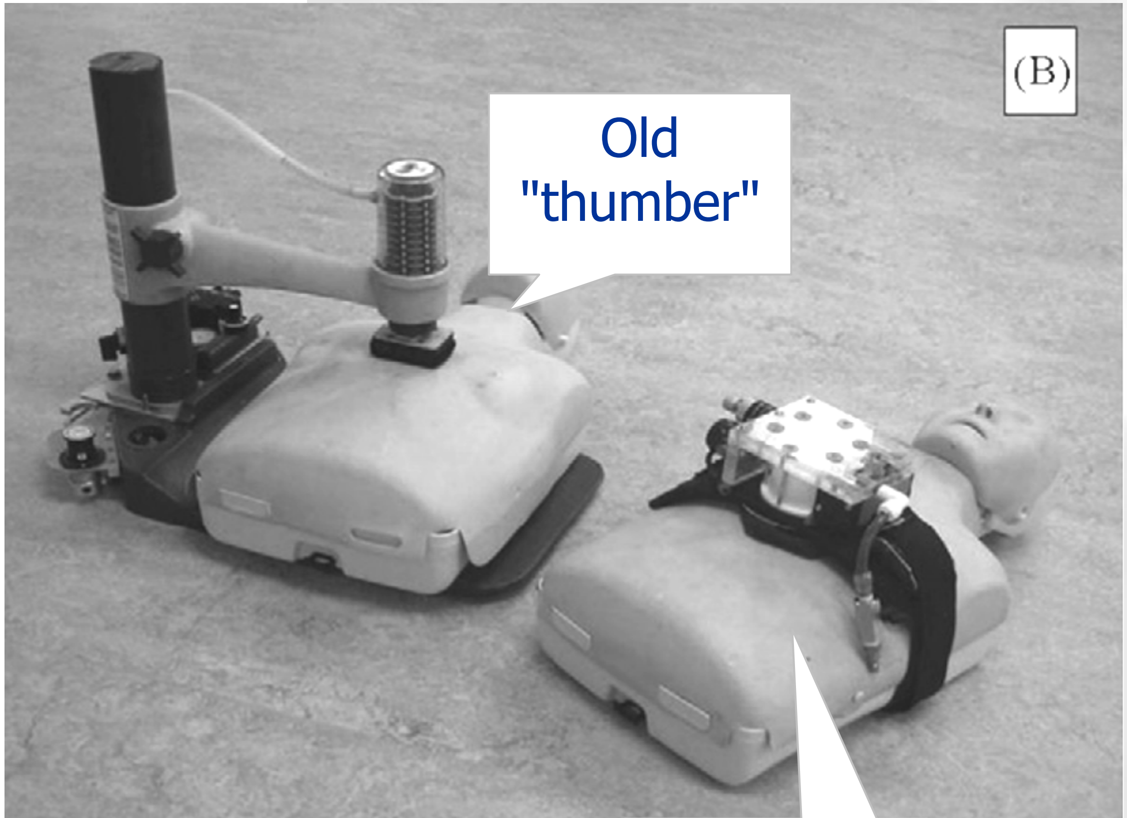
See also pp 305 and 363, and Patient Page.

Author Affiliations: National Competence Center for Emergency Medicine (Dr Wik), Institute for Experimental Medical Research (Drs Wik, Kramer-Johansen, and Steen), Division of Prehospital Emergency Medicine (Drs Wik, Sørebø, and Steen), and Division of Surgery (Dr Steen), Ulleval University Hospital, Oslo, Norway; Norwegian Air Ambulance, Department of Research and Education in Acute Medicine, Drøbak, Norway (Dr Kramer-Johansen); Laerdal Medical, Corp, Stavanger, Norway (Mr Myklebust); Sodersjukhuset, Stockholm, Sweden (Dr Svensson); London Ambulance Service NHS Trust, London, England (Dr Fellows).

Financial Disclosure: Mr Myklebust is an employee of Laerdal Medical Corp, which developed the monitor/defibrillator.

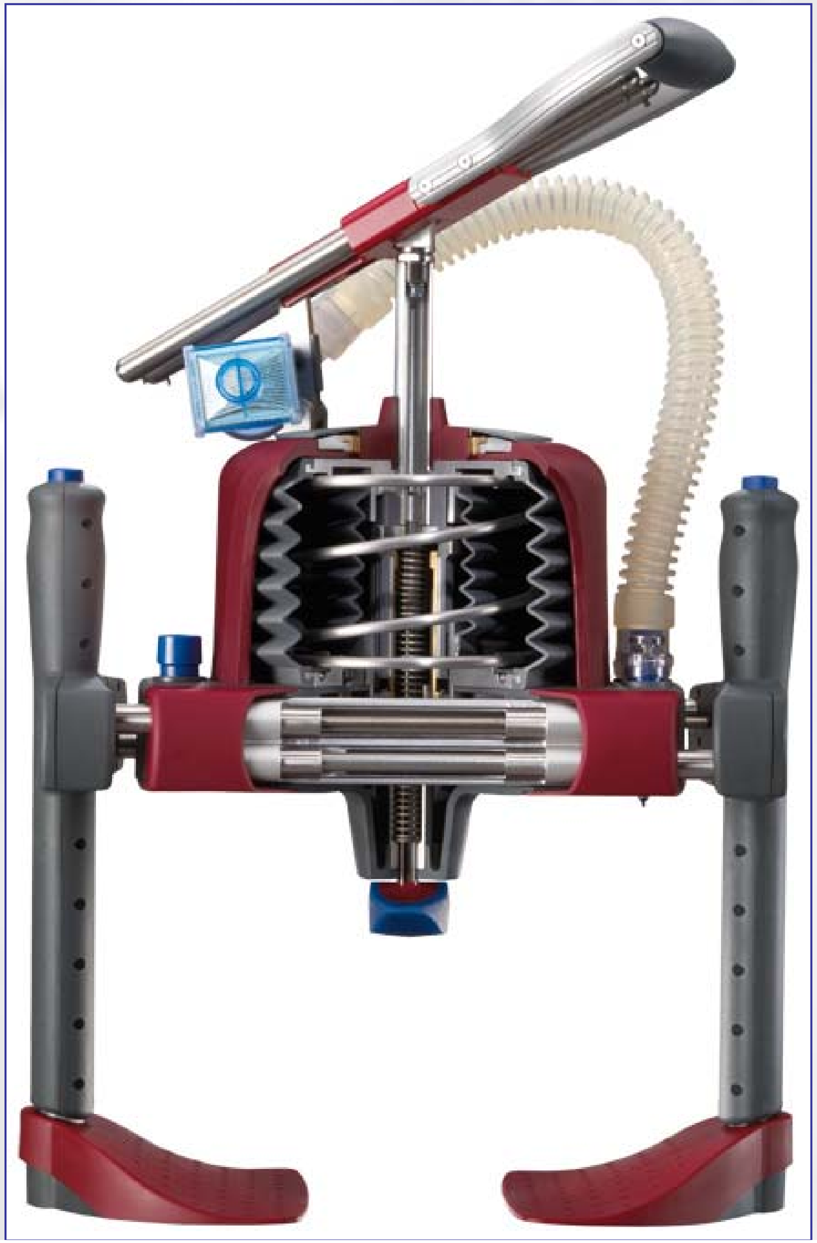
Corresponding Author: Lars Wik, MD, PhD, NAKOS, Institute for Experimental Medical Research, Ulleval University Hospital, N-0407 Oslo, Norway.

Miniaturized mechanical chest compressor: A new option for cardiopulmonary resuscitation☆

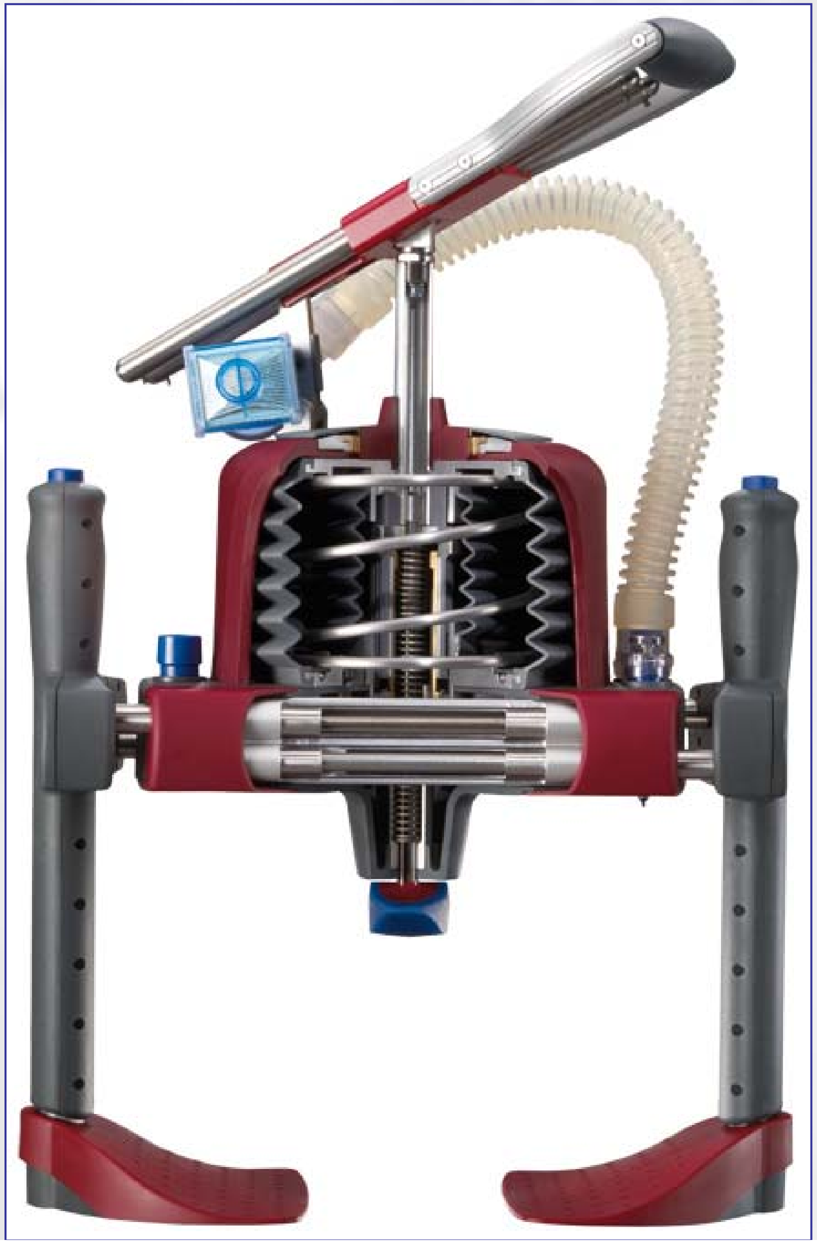


Ristagno, Resuscitation 2008

ANIMAX - Reanimation



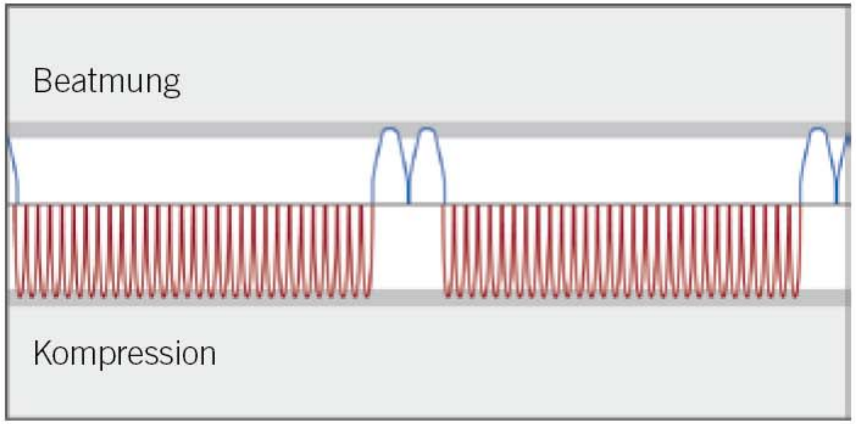
ANIMAX - Reanimation



Mechanische
CPR-Systeme

ANIMAX - Reanimation

Beatmung/Kompressions-Diagramm



Der animax entspricht der EG Richtlinie 93/42/EWG für Medizinprodukte.

Technische Änderungen dienen dem Fortschritt und bleiben vorbehalten.

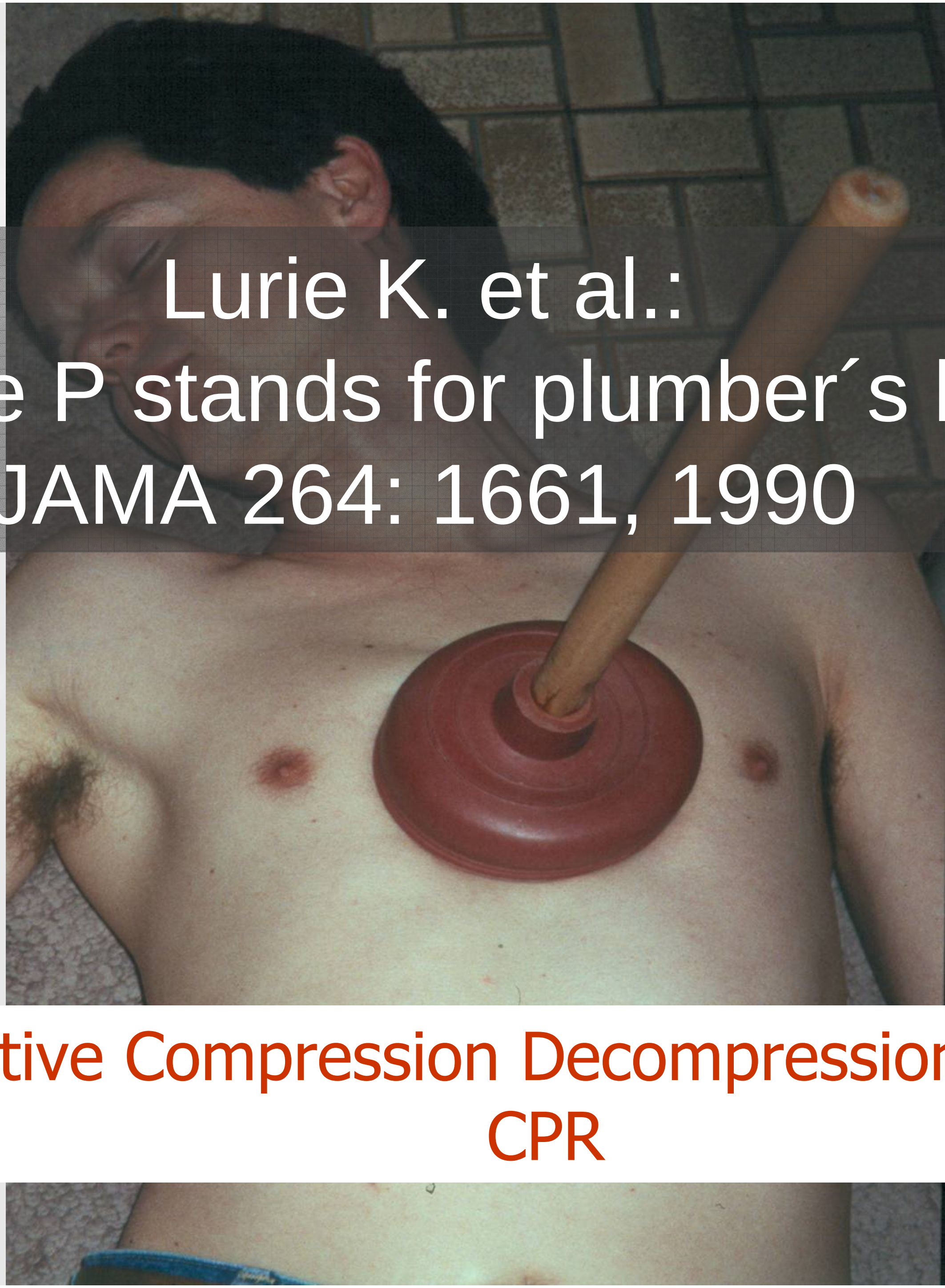
Technische und medizinische Daten

Patientengruppe	Erwachsene
Bedienung	durch eine Person
Gewicht animax	9,8 kg
Gewicht Tasche und Zubehör	4,5 kg
Aufbauzeit	ca. 20 Sekunden
Automatische Umschaltung	30:2
Beatmungsvolumen	500 - 600 ml
Eindrücktiefe	40 - 50 mm
Höhe der Tasche	38 cm
Länge der Tasche	53 cm
Tiefe der Tasche	18 cm

ANIMAX - Reanimation

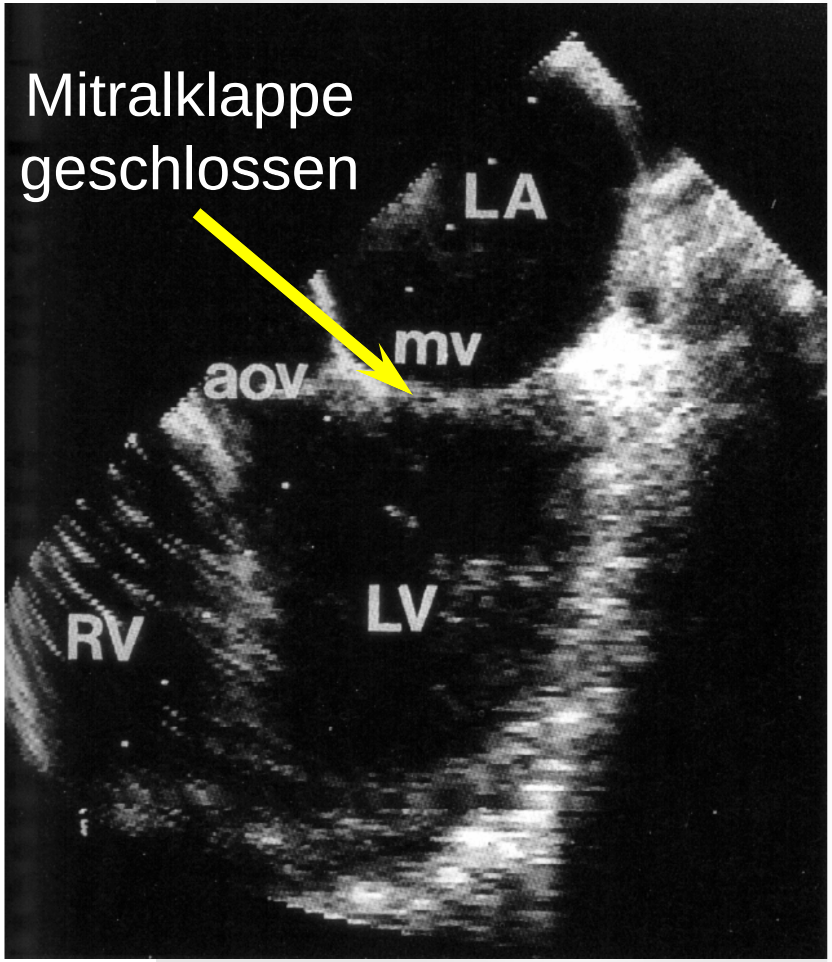
Mechanische
CPR-Systeme

Lurie K. et al.:
CPR: The P stands for plumber´s helper.
JAMA 264: 1661, 1990



Active Compression Decompression (ACD) CPR

Reperfusion = Thoraxkompressionen
ACD-CPR ➔ Steigerung des Schlagvolumens



Kompression

Cohen, JAMA 1992

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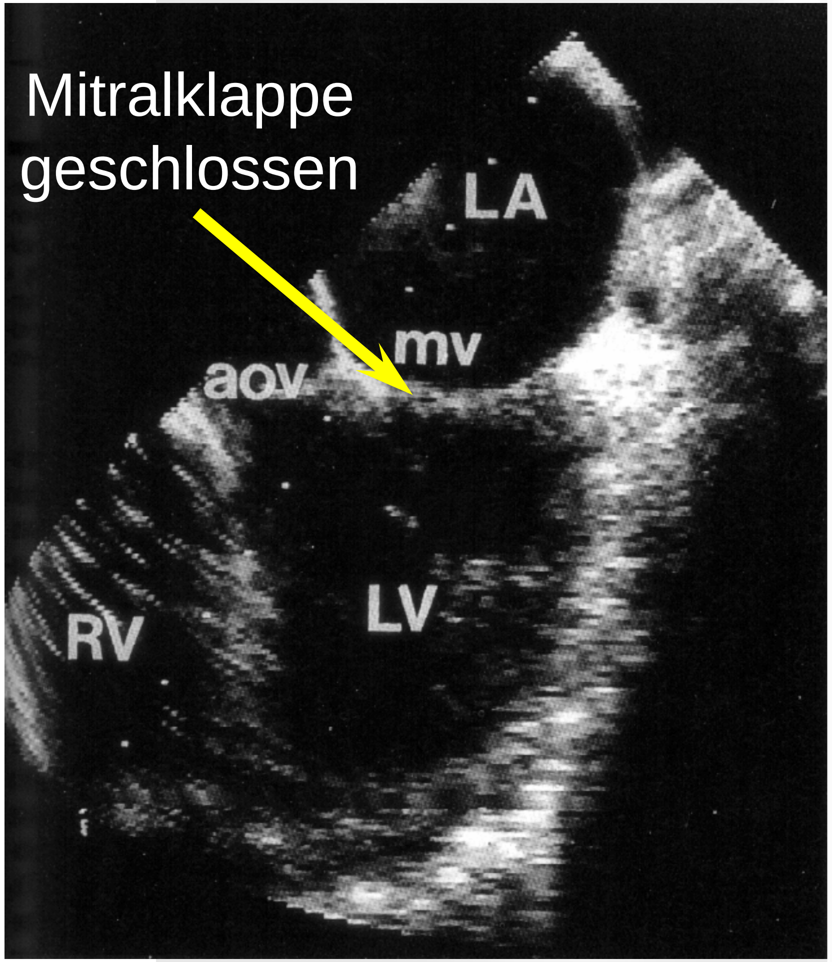
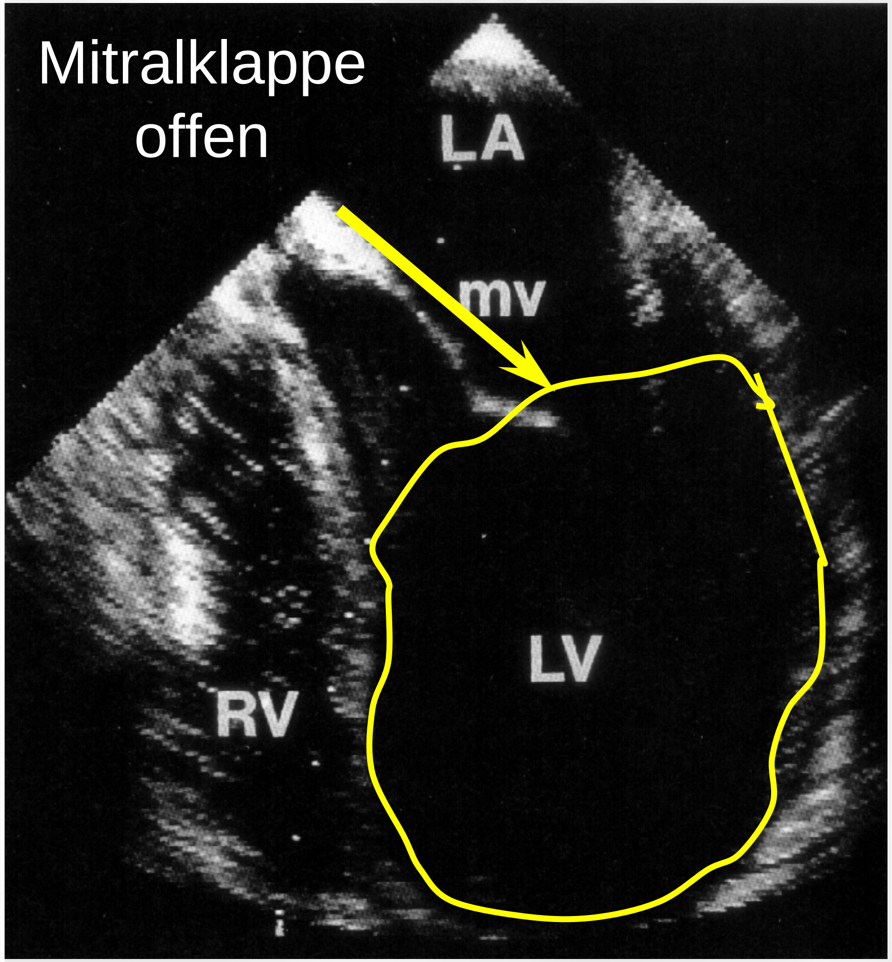
Reperfusion = Thoraxkompressionen
ACD-CPR → Steigerung des Schlagvolumens



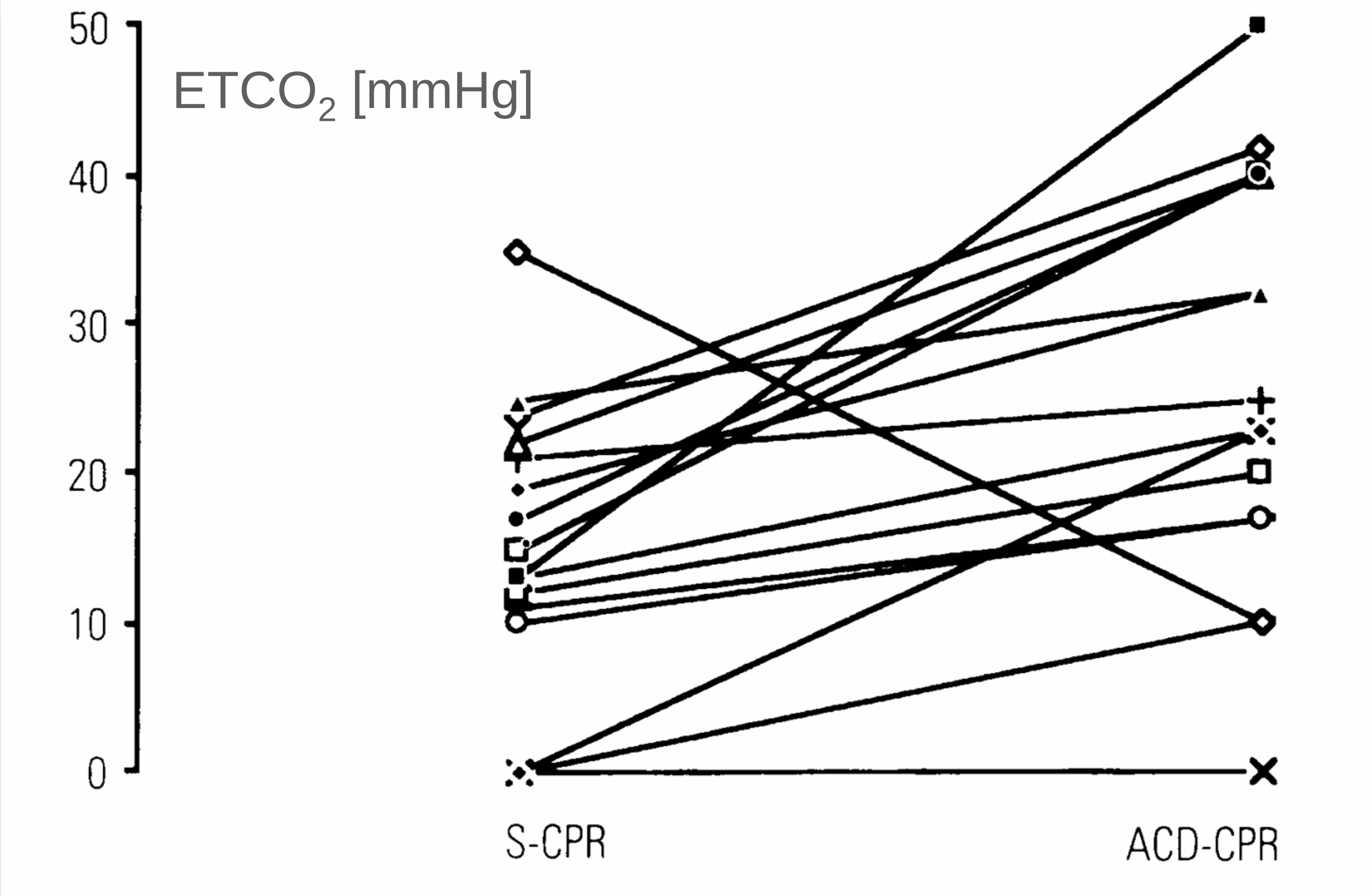
Kompression



Aktive Dekompression

Cohen, JAMA 1992

Reperfusion = Thoraxkompressionen
ACD-CPR ➔ Steigerung endexpiratorischen CO_2



Orliaguet, Ann Emerg Med 1995

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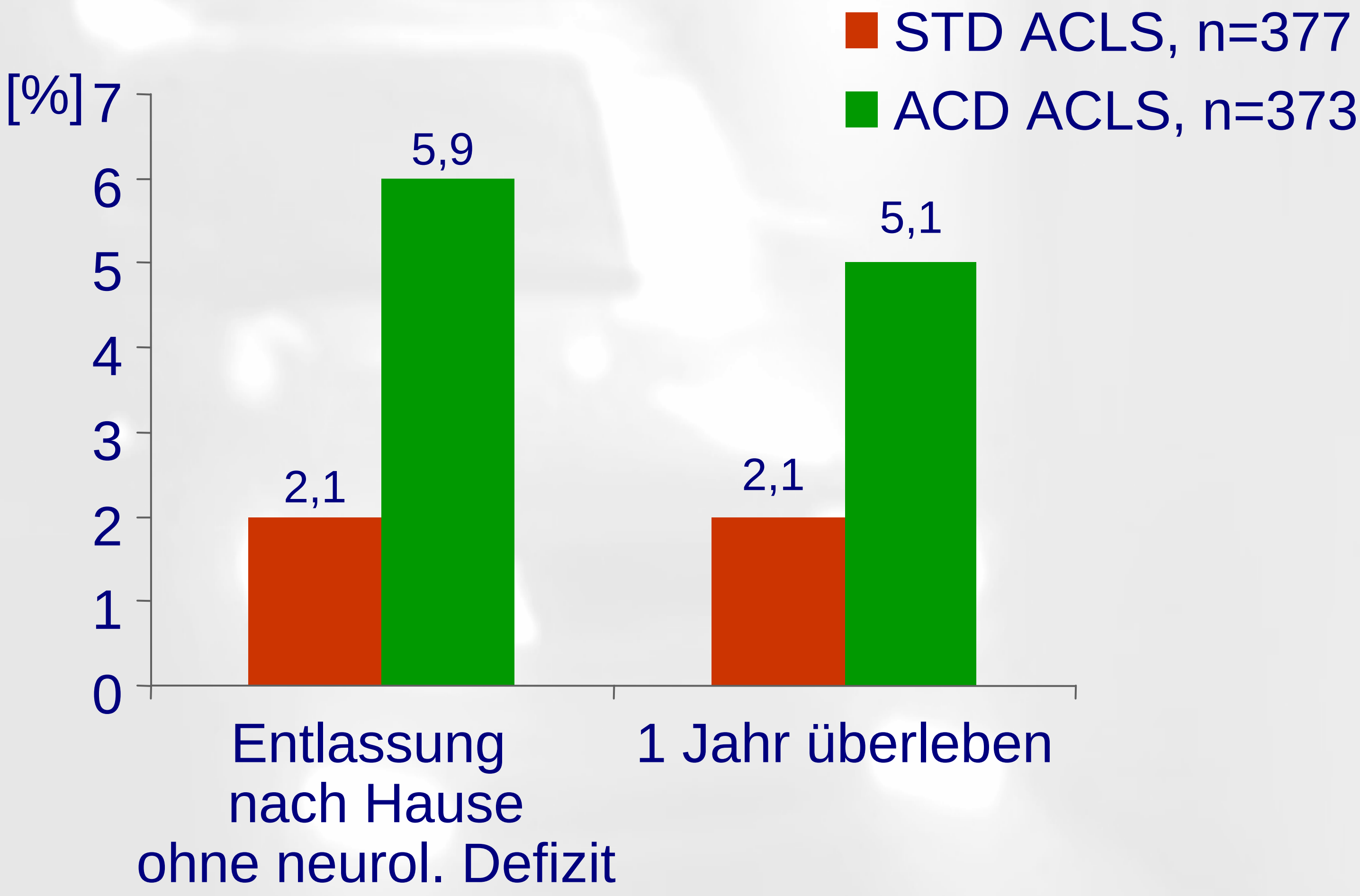
Reperfusion = Thoraxkompressionen

ACD-CPR → Steigerung des Überlebens!



p=0,01

p=0,03

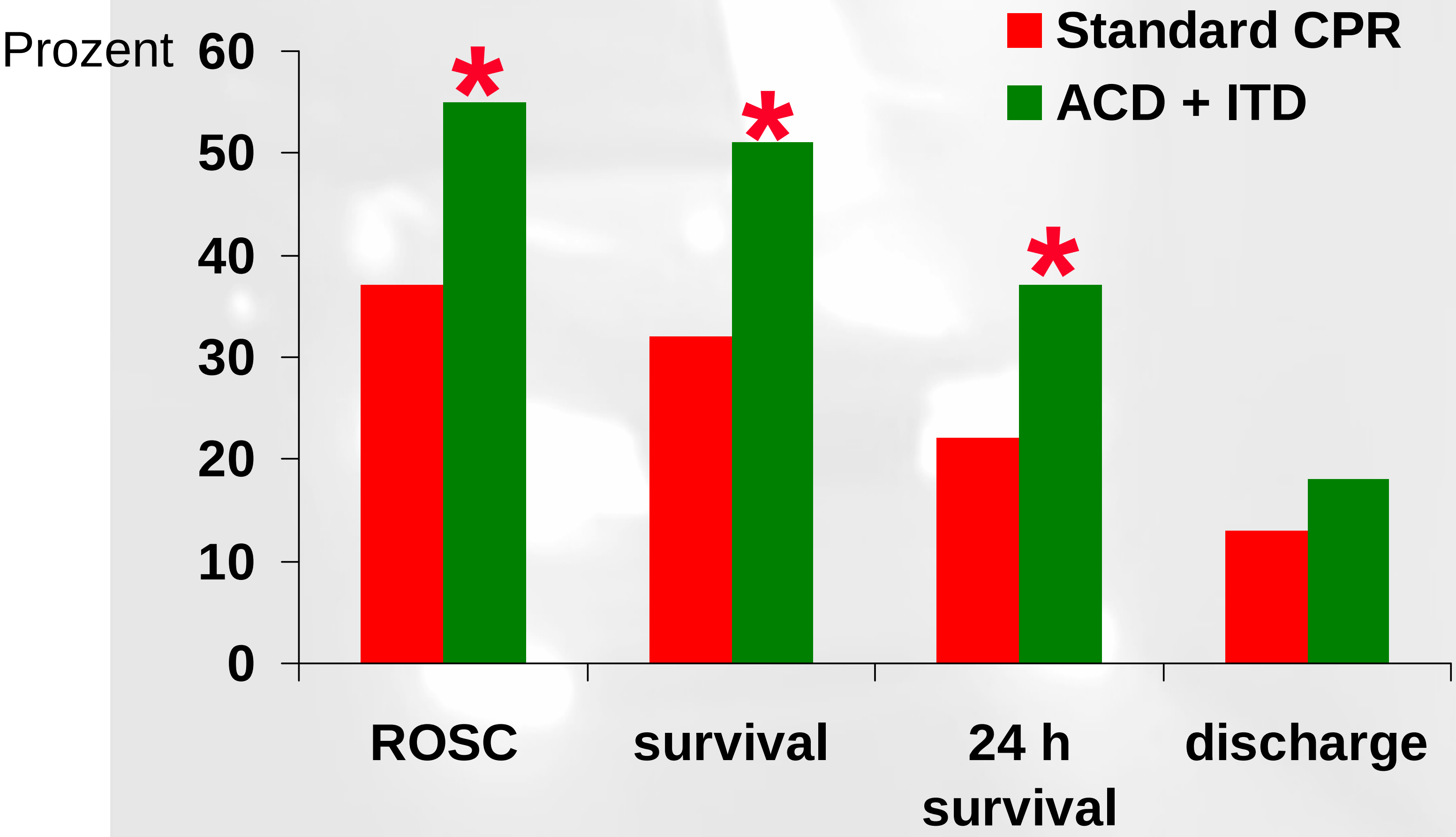
Plaisance, N Engl J Med 1999

Reperfusion = Thoraxkompressionen
ACD + ITD

Active Compression Decompression +
Impedance threshold device

Reperfusion = Thoraxkompressionen
ACD + ITD → IIa Empfehlung

Randomised Clinical Trial, n=210



Wolcke, Circulation 2003

Reperfusion = Thoraxkompressionen ACD + ITD (Göppingen / CPR Register)

	Standort [n]	Standort [%]	Gesamtdaten [n]	Gesamtdaten [%]
AED	17 / 376	4,5%	962 / 4415	21,8%
ACD-CPR	159 / 376	42,3%	422 / 4415	9,6%
Schrittmacher	7 / 376	1,9%	103 / 4415	2,3%
Offene CPR	0 / 376	0%	11 / 4415	0,2%
Zentralvenöser Zugang	6 / 376	1,6%	88 / 4415	2,0%
Intraossäre Nadel	4 / 376	1,1%	92 / 4415	2,1%
Endobronchiale Medikation	31 / 376	8,2%	452 / 4415	10,2%
Orale ITN	299 / 376	79,5%	2992 / 4415	67,8%
Nasale ITN	0 / 376	0%	10 / 4415	0,2%
Larynxmaske	0 / 376	0%	24 / 4415	0,5%
Laryntubus	0 / 376	0%	132 / 4415	3,0%
Combitubus	0 / 376	0%	43 / 4415	1,0%
Chirurgischer Atemweg	0 / 376	0%	16 / 4415	0,4%
Andere ITN	0 / 376	0%	82 / 4415	1,9%
Aktive Kühlung, JA	86 / 376	22,9%	481 / 4415	10,9%
Aktive Kühlung, Infusion	53 / 376	14,1%	206 / 4415	4,7%
Aktive Kühlung, extern	32 / 376	8,5%	205 / 4415	4,6%

Statistik präklinische Reanimationen 05.2005-10.2009 - Standortkennung 73006003 - Reanimationsregister der DGAI. Erstellt 01.10.2009 11:56:10 Seite 38

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Reperfusion = Thoraxkompressionen
LUCAS (Lund University Cardiopulmonary Assist System)

Resuscitation. 2002 Dec;55(3):285-99.

Related Articles, Links

ELSEVIER SCIENCE FULL-TEXT ARTICLE

Evaluation of LUCAS, a new device for automatic mechanical compression and active decompression resuscitation.

Steen S, Liao Q, Pierre L, Paskevicius A, Sjoberg T.

Department of Cardiothoracic Surgery, Heart-Lung Division, University Hospital of Lund, Sweden.
stig.steen@thorax.lu.se

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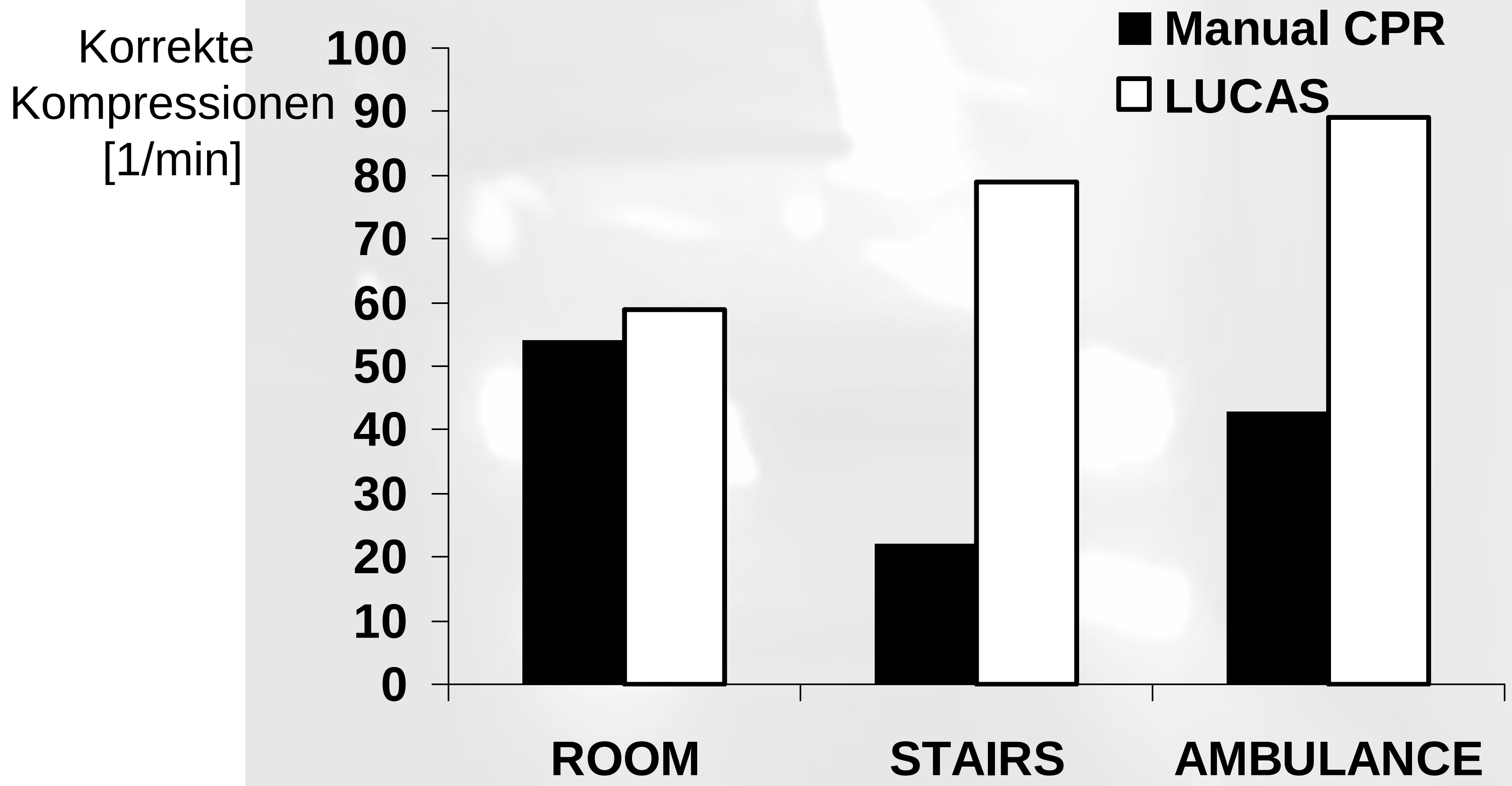
Comparison of Manual CPR with a Mechanical Device (LUCAS) in a Standardized Scene Environment Using a Manikin

Institut für Notfallmedizin Köln



Lechleuthner, ERC Abstract 5 2006

Mechanische CPR-Systeme

MF | Klinik am Eichert | GP

Resuscitation (2008) **76**, 185—190

available at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/resuscitation

CLINICAL PAPER

Quality of cardiopulmonary resuscitation before and during transport in out-of-hospital cardiac arrest☆

Theresa M. Olasveengen[a,*], Lars Wik[b], Petter A. Steen[c,d]

[a] *Institute for Experimental Medical Research and Department of Anaesthesiology, Division Ulleval University Hospital, University of Oslo, N-0407 Oslo, Norway*
[b] *The National Competence Centre for Emergency Medicine, Ulleval University Hospital, N-0407 Oslo, Norway*
[c] *University of Oslo, Faculty Division Ulleval University Hospital, N-0407 Oslo, Norway*
[d] *Division of Prehospital Medicine and Institute for Experimental Medical Research, Ulleval University Hospital, N-0407 Oslo, Norway*

Resuscitation (2008) **76**, 185—190

available at www.sciencedirect.com

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journal homepage: www.elsevier.com/locate/resuscitation

ELSEVIER

RESUSCITATION

CLINICAL PAPER

Quality of cardiopulmonary resuscitation before and during transport in out-of-hospital cardiac arrest☆

Results: Seventy-five of 787 consecutive out-of-hospital cardiac arrest patients met the inclusion criteria. Quality data were available from 36 of 66 patients receiving manual CPR and 7 of 9 receiving mechanical CPR. CPR was performed for mean 21±11 min before and 12±8 min during transport. With manual CPR hands-off ratio increased from 0.19±0.09 on-scene to 0.27±0.15 (p = 0.002) during transport. Compression and ventilation rates were unchanged causing a reduction in compressions per minute from 94±14 min−1 to 82±19 min−1 (p = 0.001). Quality was significantly better with mechanical than manual CPR.

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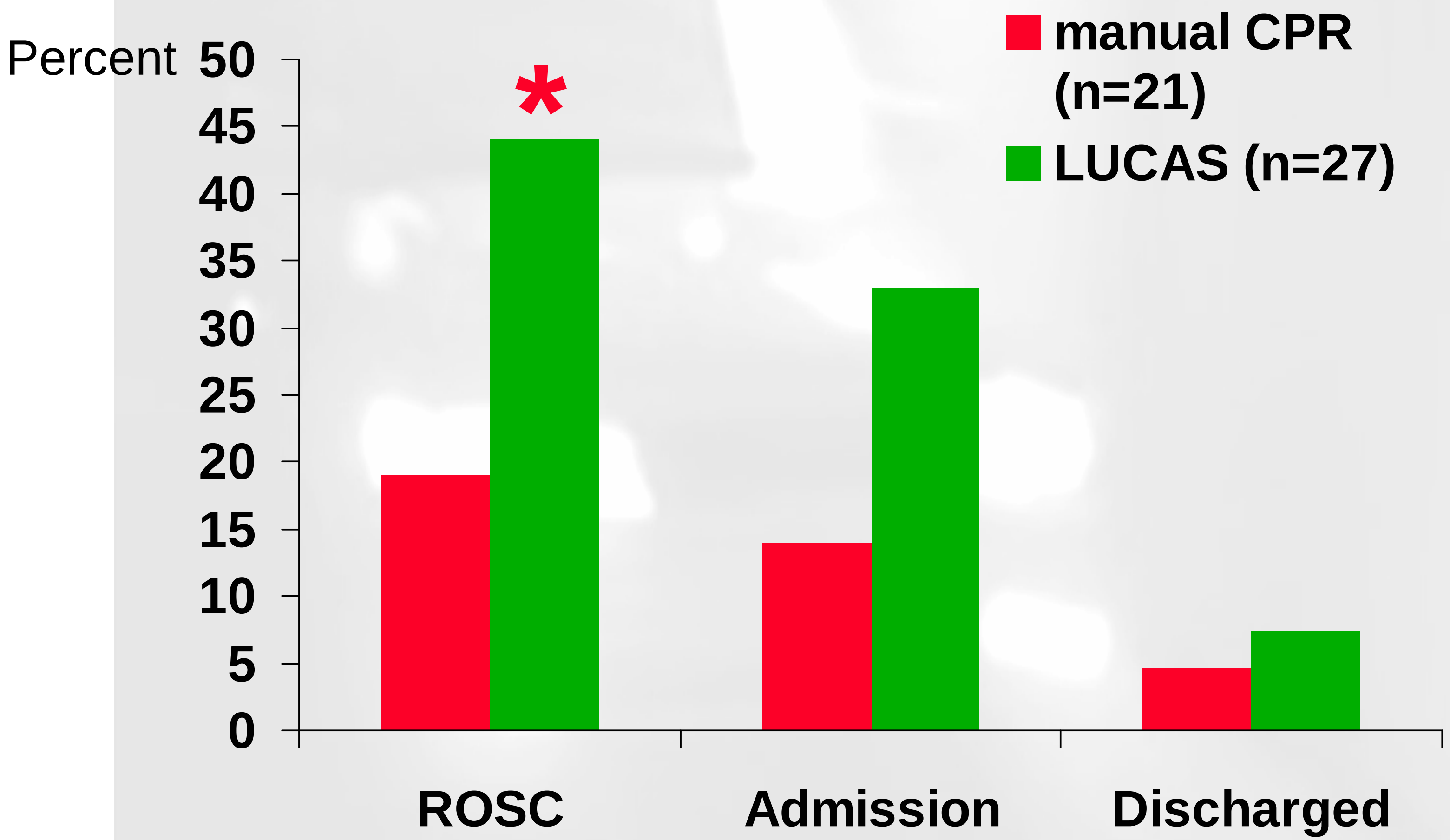
Increased ROSC after Cardiac Arrest with the LUCAS Device Compared to Manual Chest Compression A Pilot Study



S. Rubertsson (Uppsala), ERC Abstract 5 2006

Mechanische CPR-Systeme
MF Klinik am Eichert GP

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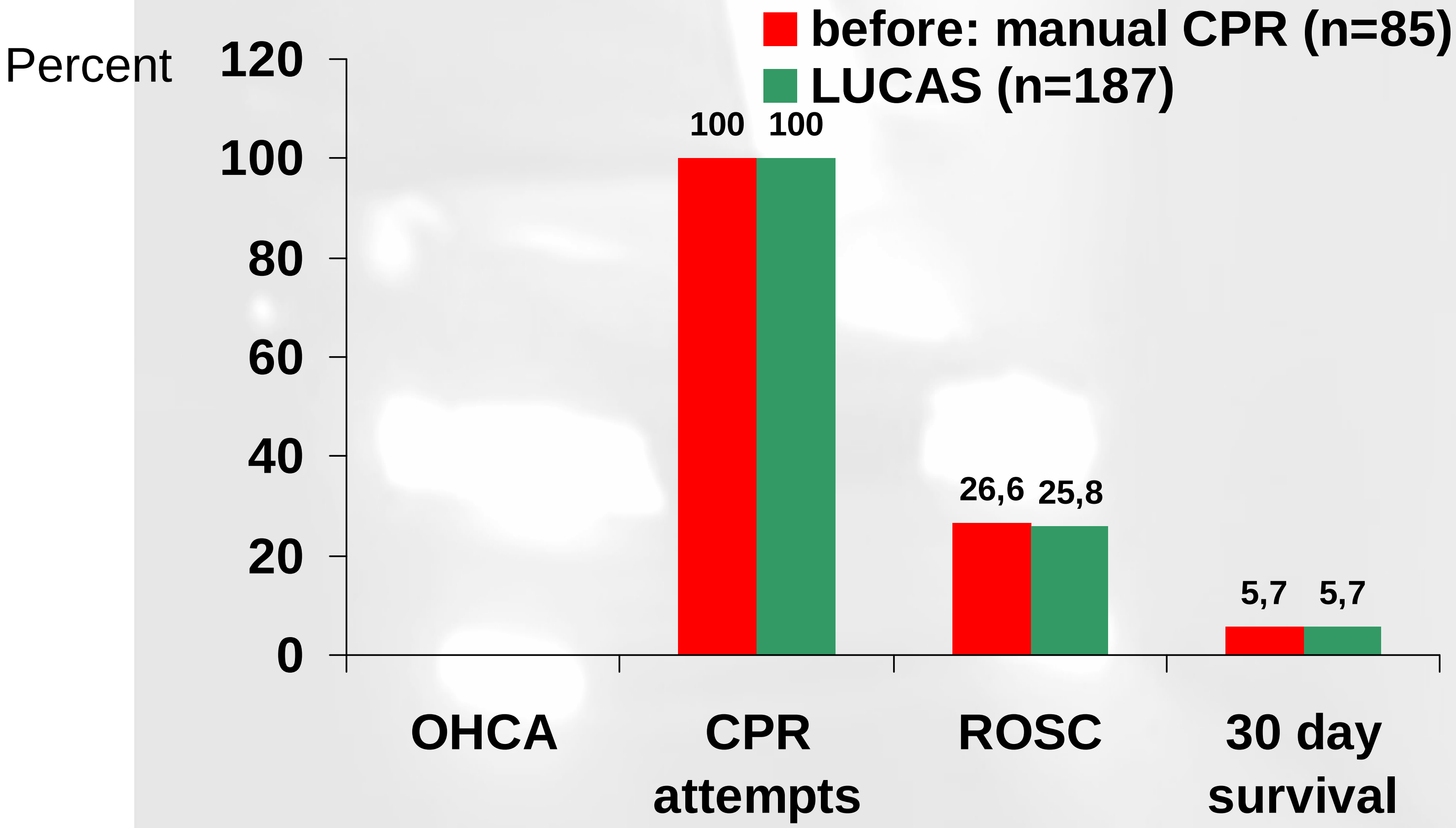
The outcome of cardiac arrest the years before and after introduction of LUCAS in the ambulances

(OHCA: before 1 2000-02, after 2003-06)



Olsona (Lund), ERC 2008, AS-023

Clinical paper

Mechanical active compression–decompression cardiopulmonary resuscitation (ACD-CPR) versus manual CPR according to pressure of end tidal carbon dioxide ($P_{ET}CO_2$) during CPR in out-of-hospital cardiac arrest (OHCA)☆

C. Axelsson[a], T. Karlsson[b], Å.B. Axelsson[c], J. Herlitz[b,*]

[a] Göteborg EMS System, Göteborg, Sweden
[b] Institute of Medicine, Department of Molecular and Clinical Medicine, Sahlgrenska University Hospital, SE-413 45 Göteborg, Sweden
[c] Institute of Health and Caring Science, Sahlgrenska Academy at Gothenburg University, Göteborg, Sweden

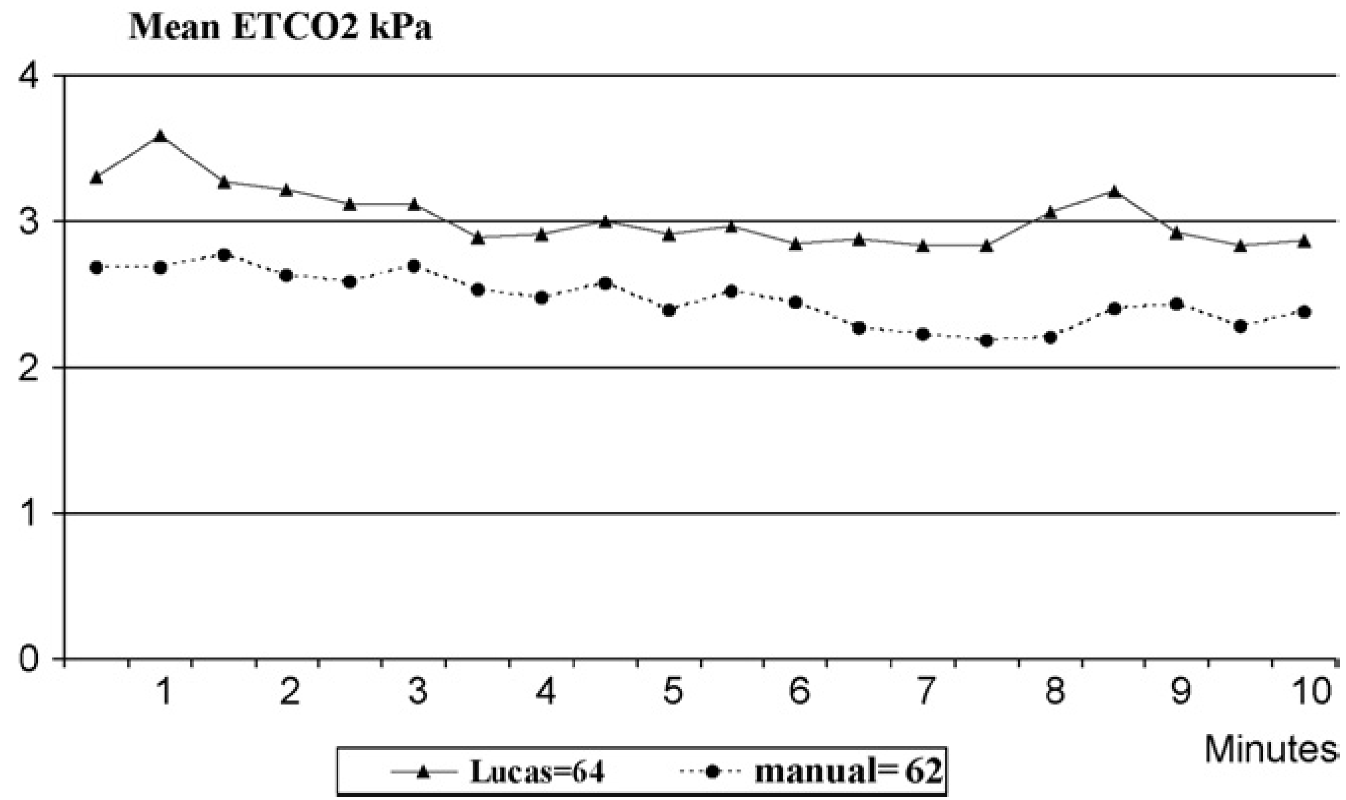


Fig. 2. Mean $EtCO_2$ values recorded at 30 s intervals for LUCAS and standard CPR arms. Note that the LUCAS device was applied prior to the first reading of $EtCO_2$.

C. Axelsson et al. / Resuscitation 80 (2009) 1099–1103

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OCTOBER 2 - 3

Clinical paper

Mechanical active compression–decompression cardiopulmonary resuscitation (ACD-CPR) versus manual CPR according to pressure of end tidal carbon dioxide ($P_{ET}CO_2$) during CPR in out-of-hospital cardiac arrest (OHCA)☆

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Chest compressions	Manual N=62	LUCAS N=64	P-Value
Outome (%)			
ROSC	52 (39,5-63,3)	44 (32,3-55,9)	0,47
Admitted alive	32 (21,9-44,7	31 (21,2-43,4)	1,00
Discharged alive	3 (0,2-11,7)	3 (0,3-11,3)	1,00

C. Axelsson et al. / Resuscitation 80 (2009) 1099–1103

Fatal complication secondary to mechanical chest compression device

Sir,

We describe a fatal complication of a mechanical chest compression device. A 48-year-old woman with clinical signs of a cerebrovascular accident had an asystolic cardiac arrest, witnessed by a paramedic, during transport in the ambulance. She was resuscitated using the Lund University Cardiac Assist System (LUCAS®) and transported to our hospital. In the emergency room, return of spontaneous circulation (ROSC) was achieved with sinus rhythm and an initial blood pressure of 70/40 mmHg that gradually increased. Echocardiography and brain computed tomography were normal.

Later, on the intensive care unit, the woman developed progressive hypotension and tachycardia. On physical examination, she had gross abdominal distention. A decreased hemoglobin concentration and an abdominal ultrasound suggested an abdominal bleeding. Because of a progressive loss of blood pressure, manual chest compressions were started and an emergency laparotomy was performed.

Figure 1. This picture shows the marks of the suction cup on the patient's chest. Of note is the pattern of migration of the suction cup from midsternum towards the right upper quadrant of the abdomen.

Laparotomy revealed massive bleeding from a laceration of the liver associated with a rupture of the right hepatic vein at the insertion of the inferior vena cava. Despite meticulous abdominal packing, haemostatic suturing, massive transfusion and high doses of inotropes, the severe hypotension persisted and the woman eventually died of the extensive hypovolaemic shock.

The LUCAS® is a pneumatic mechanical pump, driven by compressed air, which performs active decompression as well as compression with a pneumatic force of 500 N on the thoracic wall and a frequency of 100 cycles/min. Although initially developed for maintenance of coronary perfusion for cardiac transplantation procedures, the system showed excellent resuscitation results and was introduced clinically in Sweden in 2000. Some cohort studies showed that mechanical compression–decompression resuscitation produced better organ perfusion and more frequent ROSC compared with manual chest compressions.[1,2] Other studies showed no significant difference but emphasized the advantage of freeing the hands of the rescue-team. In safety studies, complications such as rib and sternal fractures have been described but these were thought to be no more common than those occurring with manual chest compressions.[3] A device-induced tension pneumothorax has been described recently.[4]

In a safety study, LUCAS® did not move on a manikin in a crash test at 30 km/h.[5] If placed correctly, it resists decelerations up to 10 G and stays positioned correctly. It is possible that the LUCAS® moved on our patient because it was initially positioned incorrectly. Figure 1 shows clearly that the suction cup has migrated from the correct midsternal position towards the right upper quadrant of the abdomen. Although ROSC was achieved by LUCAS®, the patient eventually died from a laceration of the liver and rupture of the right hepatic vein.

Conflict of interest statement

None to declare.

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3. Rubertsson S, Huzevka T, Smekal D, Johansson J. Mechanical chest compressions with the LUCAS device does not increase the incidence of injuries in cardiac arrest victims. Circulation 2007;116 [II 930 Abstract 32].
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Clinical paper

No difference in autopsy detected injuries in cardiac arrest patients treated with manual chest compressions compared with mechanical compressions with the LUCAS™ device—A pilot study☆

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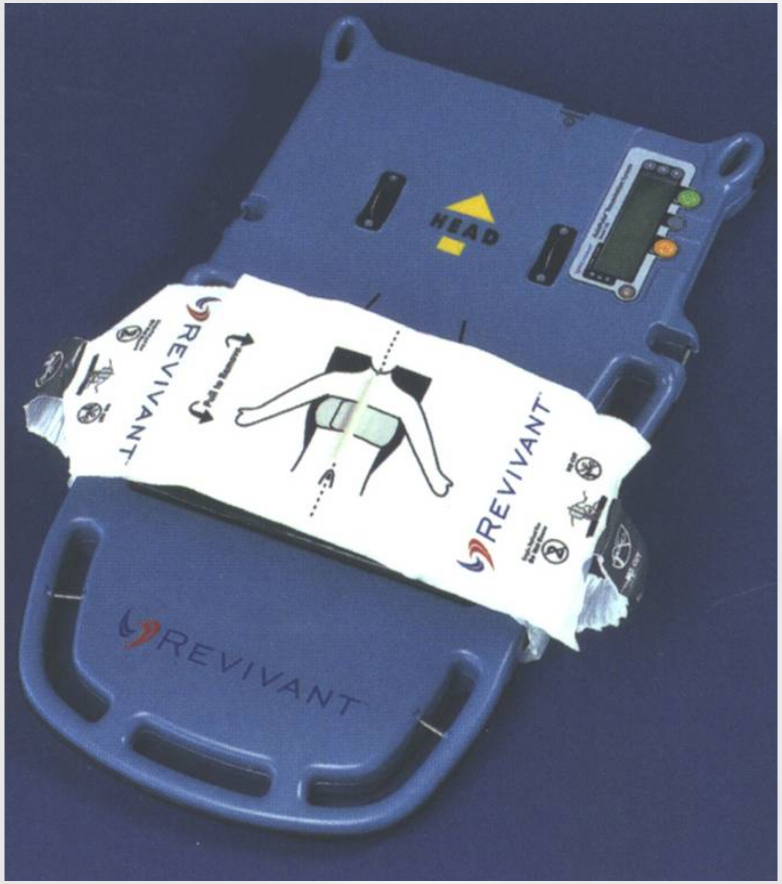
Table 2
Number of injuries detected by autopsy.

Injury	LUCAS, *n* (%)	Manual, *n* (%)	*p* value
	38	47	
Skin wound	3 (7.9)	0 (0)	0.09
Skin marks	13 (34.2)	0 (0)	<0.001
Sternal fracture	11 (29.0	10 (21.3)	0.46
Rib fractures <3	1 (2.6)	2 (4.3)	1.00
Rib fractures ≥3	17 (44.7)	13 (27.7)	0.12
Bleeding in the ventral mediastinum	3 (7.9)	2 (4.3)	0.65
Retrosternal bleeding	3 (7.9)	1 (2.1)	0.32
Epicardial bleeding	4 (10.5)	1 (2.1)	0.17
Pericardial bleeding	3 (7.9)	4 (8.5)	1.00
Ruptured abdominal aortic aneurysm	1 (2.6)	0 (0)	0.45
Thoracic aortic dissection	1 (2.6)	0 (0)	0.45
Rupture of the thoracic aorta	0 (0)	1 (2.1)	1.00
Bleeding from lung parenchyma	1 (2.6)	0 (0)	0.45
Pneumothorax	1 (2.6)	1 (2.1)	1.00
Injury to the liver	1 (2.6)	0 (0)	0.45
Injury to the spleen	0 (0)	1 (2.1)	1.00
No injuries	16 (42.1)	26 (55.3)	0.28

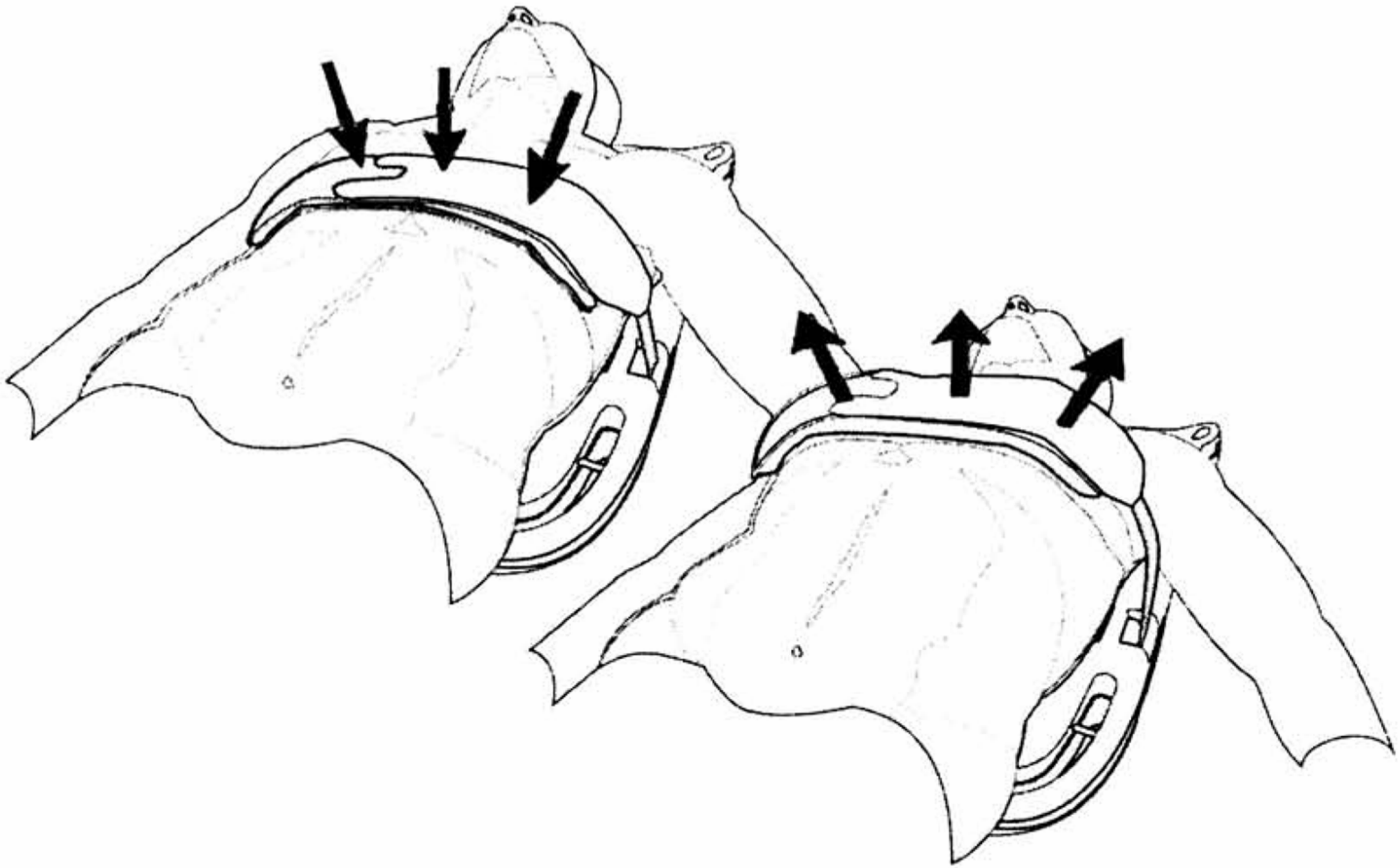
D. Smekal et al. / Resuscitation 80 (2009) 1104–1107

RESUSCITATION 2009
COLOGNE - GERMANY
OCTOBER 2-3

Reperfusion = Thoraxkompressionen
AutoPulse ➔ IIb Empfehlung



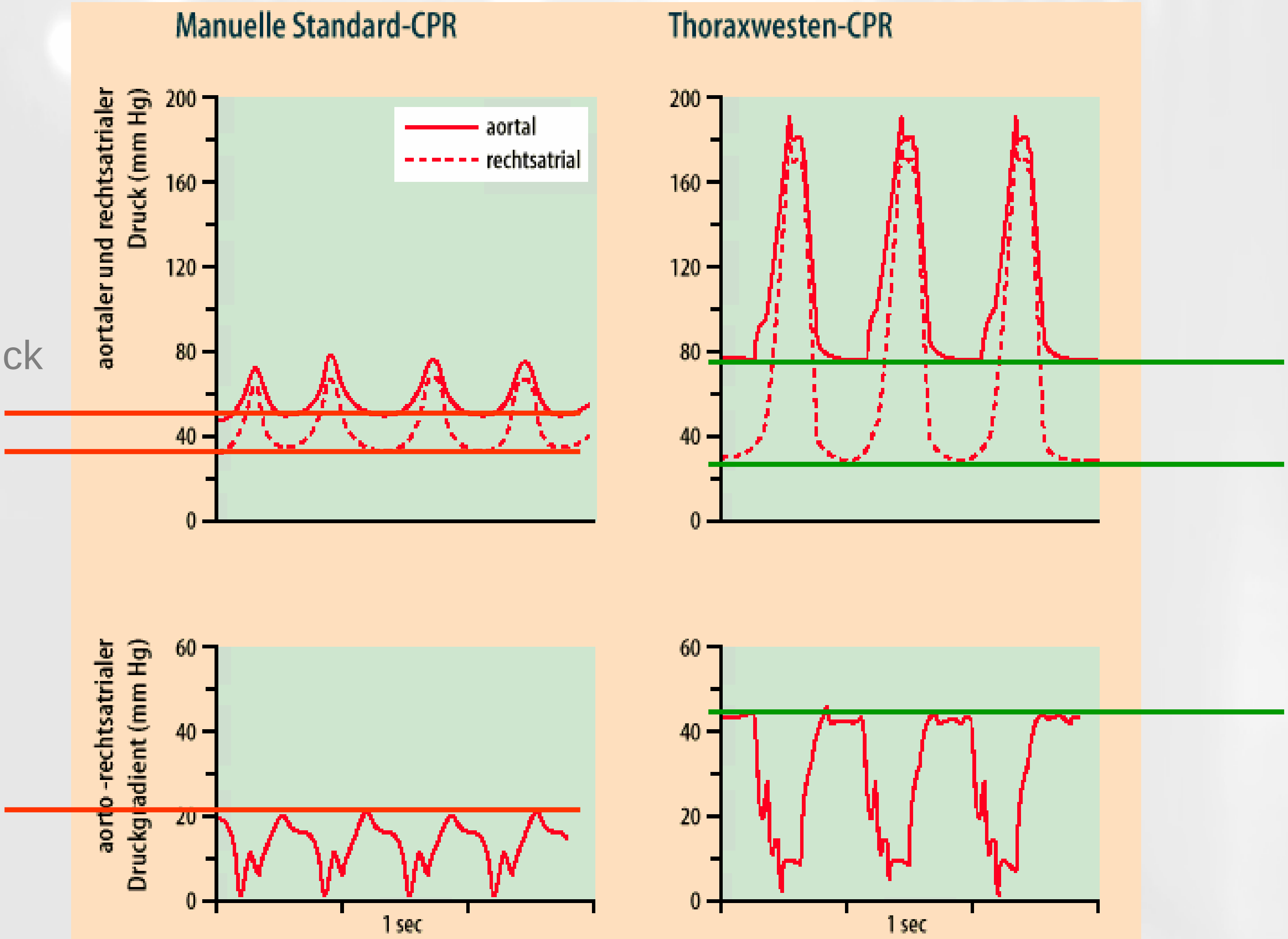
Thorax-Pump-Mechanismus bei AutoPulse



Casner M. et al, Preh Emerg Care, 2005

Reperfusion = Thoraxkompressionen
Westen-CPR, tierexperimentell

Perfusionsdruck

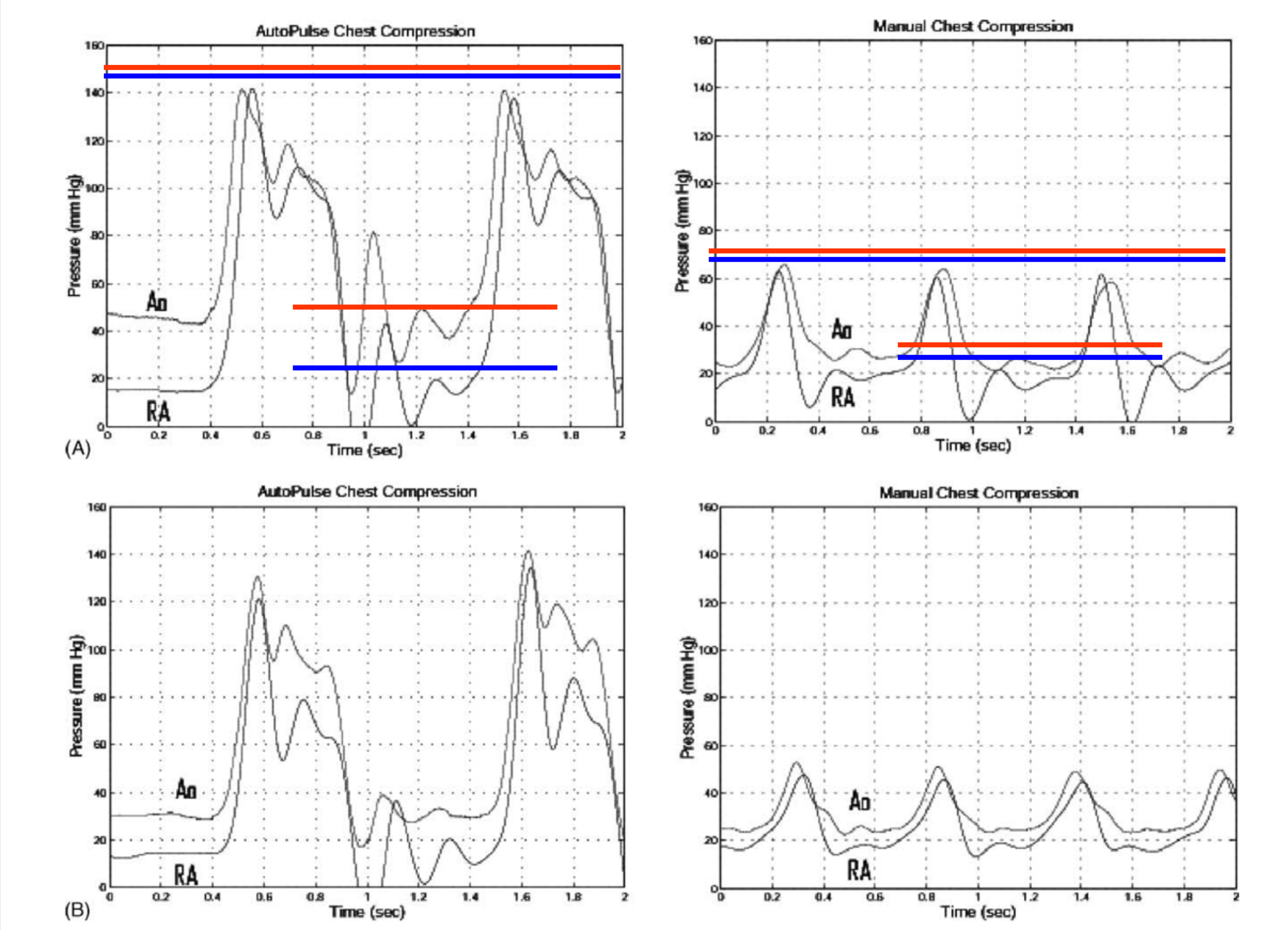


Halperin, N Engl J Med 1993

RESUSCITATION 2009 COLOGNE - GERMANY OCTOBER 2 - 3

Reperfusion = Thoraxkompressionen

AutoPulse Klinik: Verbesserte Reperfusion



S. Timerman et al. / Resuscitation 61 (2004) 273–280

RESUSCITATION 2009
COLOGNE - GERMANY
OCTOBER 2-3

Out of Hospital CPR with the AutoPulse™ System: A Prospective Observational Study

Rettungsdienst Bonn

CPR characteristics: all patients (n = 46)

		mean		SD	median
Duration until AutoPulse setup	(min)	4/7	±	5/9	2
AutoPulse CPR	(min)	18/4	±	12/3	17
sufficient	(%)	91.3			
palpable pulse*	(%)	77.8			
conversion asystole/PEA into shockable ECG-rhythm	(%)	41.3			
DC-countershocks	(n)	3/8	±	5/9	1
ROSC	(%)	54.3			

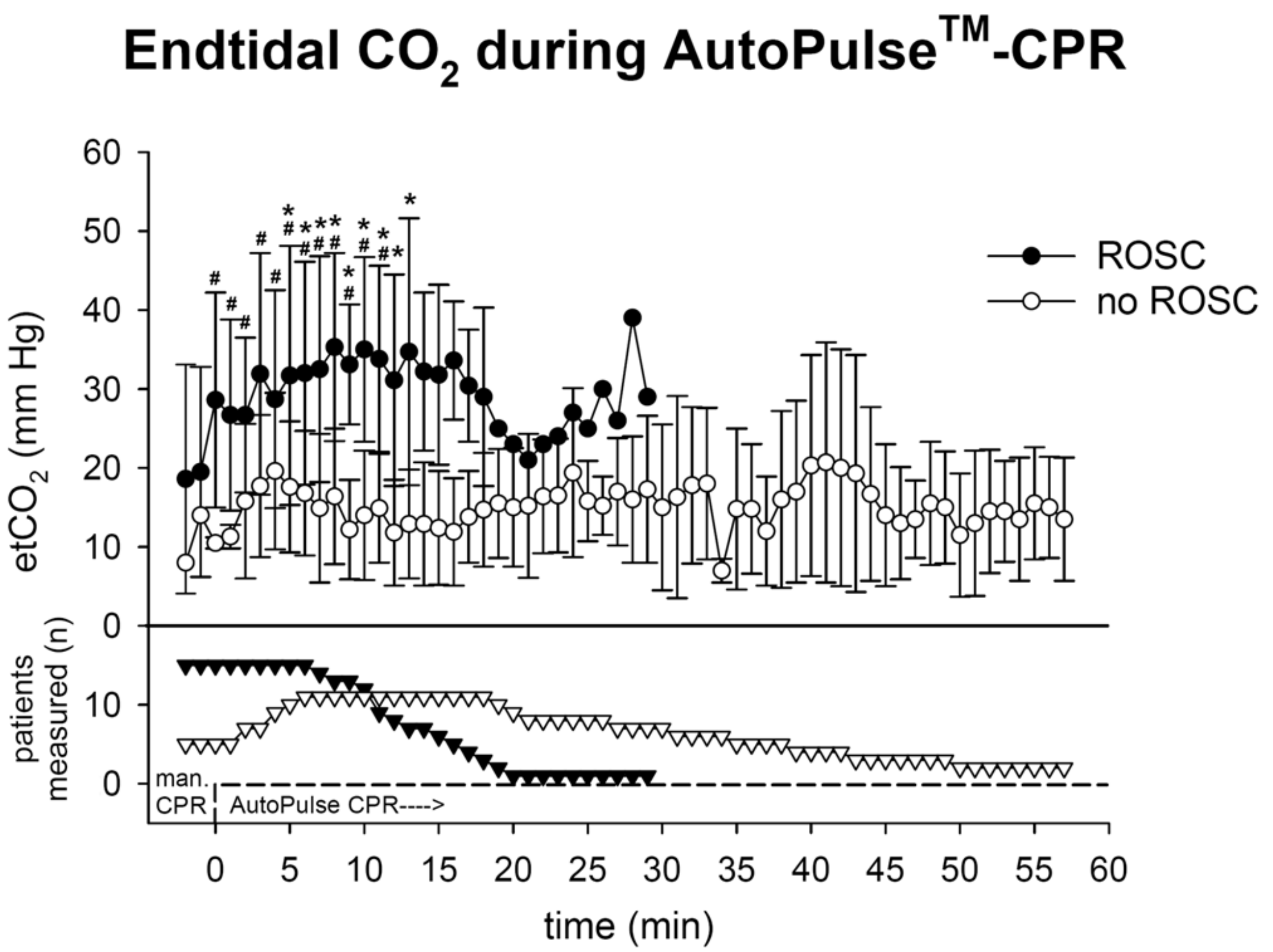
*: Carotid or femoral artery.

Krep, Resuscitation 2007

RESUSCITATION 2009 COLOGNE - GERMANY OCTOBER 2 - 3

Out of Hospital CPR with the AutoPulse™ System: A Prospective Observational Study

Rettungsdienst Bonn



Krep, Resuscitation 2007

Fallbeispiele:

Anaesthesist 2008 · 57:582–588
DOI 10.1007/s00101-008-1376-0
Online publiziert: 2. Mai 2008

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Notarzt und AutoPulse – ein gutes Duo im Rettungsdienst?

Fallbeispiel und Erfahrungsbericht

Im folgenden Fallbericht wird über einen 66-jährigen Patienten, der sich am Einsatzort durch die Reanimationsmaßnahmen nicht stabilisieren und in einen spontanen Kreislauf überführen ließ, berichtet. Da aufgrund der Fremdanamnese der hochgradige Verdacht auf einen akuten Myokardinfarkt bestand, wurde der Patient unter Einsatz des AutoPulse zur Koronarangiographie in das nächstgelegene Katheterzentrum transportiert und konnte durch eine perkutane koronare Intervention (PCI) stabilisiert werden. Neben diesem Fallbeispiel werden die Erfahrungen nach mehr als 3-jährigem Einsatz des AutoPulse im Notarzt- und Rettungsdienst der Stadt Bonn dargestellt.

Das Überleben nach einem Herz-Kreislauf-Stillstand bleibt trotz erheblicher Bemühungen zur Verbesserung der kardiopulmonalen Reanimation (CPR) und Weiterentwicklungen der elektrischen Defibrillation weiterhin gering; die unbefriedigende Erfolgsrate von Reanimationsversuchen hat sich in den vergangenen 30 Jahren nicht wesentlich verbessert [7]. Auf dem Weg den Behandlungserfolg („outcome") zu steigern, wurde in letzter Zeit das Hauptaugenmerk auf den frühzeitigen Beginn und die Qualität der CPR gelegt, verbunden mit einer möglichst frühzeitigen Defibrillation bei entsprechender Indikation [26]. Neben den zeitlichen Determinanten, d. h. Abstand zwischen Herz-Kreislauf-Stillstand und Beginn der Reanimation sowie der Dauer der Reanimation, scheint nach den Ergebnissen klinischer und tierexperimenteller Studien eine effektive Thoraxkompression mit Vermeidung von Unterbrechungen für die Aufrechterhaltung eines adäquaten koronaren Perfusionsdrucks und damit für das Überleben von hoher Bedeutung zu sein [3]. Insbesondere Unterbrechungen der Thoraxkompression reduzieren die Chancen auf einen Defibrillationserfolg in hohem Maß [29]. Die jüngsten Änderungen der Internationalen Reanimationsrichtlinien (2005) tragen diesen, zwar nicht neuen, aber zuletzt verstärkt beachteten Erkenntnissen Rechnung [13]. So stellt häufig die größte Fehlerquelle bei einer CPR der Helfer selbst dar, denn insbesondere Erschöpfung, Ablenkung und Konzentrationsschwäche des Helfers führen zu einem erheblichen Qualitätsverlust oder zu Unterbrechungen der Thoraxkompressionen [12]. In der Vergangenheit wurden bereits verschiedene Reanimationsassistenzgeräte mit dem Ziel, eine effektive und kontinuierliche Thoraxkompressionen zu erreichen, entwickelt und mit unterschiedlichem Erfolg eingesetzt, z. B. die pneumatische Thoraxweste [10] oder der „thumper" (Michigan Instruments) [18]. Als neuere Entwicklungen werden zurzeit das AutoPulse- und das LUCAS-System im klinischen und im präklinischen Einsatz hinsichtlich ihrer Effektivität untersucht [27, 20].

Das AutoPulse-Reanimationssystem (Zoll Medical Deutschland) wurde im Rettungsdienstbereich der Bundesstadt Bonn erstmals von September 2004 bis

Abb. 1 ▲ Der AutoPulse 1.5 G mit Rückenbrett und Kompressionsgurt, Abmessungen L 83*B 45*H 8 cm. (Mit freundlicher Genehmigung durch Zoll Medical Deutschland GmbH)

Notfall Rettungsmed 2008
DOI 10.1007/s10049-008-1095-8

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Autopulse®-gestützte CPR

Neue Chancen für Patienten mit Herz-Kreislauf-Stillstand?

Fallbericht

Am 23.08.2007 alarmierte die Rettungsleitstelle Ulm um 12.45 Uhr ein Notarzteinsatzfahrzeug (NEF) und einen Rettungswagen (RTW) mit der Einsatzmeldung *bewusstlose Person*.

Der ersteintreffende Notarzt (◘ Tab. 1) fand einen etwa 35-jährigen Mann mit Atem- und Kreislaufstillstand im 2. Stock seines Elternhauses auf dem Bett liegend vor.

In der Elektrokardiographie (EKG)-Schnellableitung fand sich als primärer Rhythmus *Kammerflimmern*.

Der Vater des Patienten hatte bis zum Eintreffen des Rettungsdienstes den Versuch unternommen, durch beidseitigen lateralen thorakalen Druck in Herzrichtung ohne Beatmung eine Wiederbelebung zu beginnen. Da die Reanimationsbemühungen des Vaters als inadäquat eingeschätzt wurden, führte das Rettungsteam (NEF) bis zur Einsatzbereitschaft des Defibrillators und der ersten Defibrillation (Lifepak 12®, Medtronic, 150 J) eine einminütige Basisreanimation durch.

Nach der ersten Defibrillation wurde die Herzdruckmassage mit dem mitgeführten AutoPulse®-Reanimationssystem (Zoll) fortgeführt (◘ Abb. 1).

Dazu wurde das Thoraxkompressionsband um den entkleideten Oberkörper des auf dem Autopulse® liegenden Patienten geschlossen und die mechanische Kompression mit einer Frequenz von 80/min gestartet.

Die AutoPulse®-gestützte kardiopulmonale Reanimation (CPR) wurde intermittierend beatmend nach den Leitlinien des „European Resuscitation Council" (ERC) fortgesetzt. Die Defibrillation im vierten Zyklus (200 J biphasisch) war erfolgreich und terminierte um 13.03 Uhr („return of spontaneous circulation", ROSC) das Kammerflimmern.

Nach dem ROSC wurde der systolische Blutdruckwert durch fraktionierte Adrenalingabe von jeweils 20 µg auf einen Wert ≥90 mmHg systolisch angehoben. Der Patient wurde mit 0,1 mg Fentanyl und 5 mg Midazolam analgosediert.

Noch vor Ort begann das Rettungsteam mit der Kühlung des Patienten mit 4°C kalter Elektrolytlösung (insgesamt 1000 ml bis zum Eintreffen in der Klinik, Ausstattung des NEF), dazu wurde der Patient mit 10 mg Vecuronium relaxiert.

Der Transport des Patienten in den Rettungswagen und auf die internistische Intensivstation des Universitätsklinikums Ulm verlief problemlos.

Anamnese

Fremdanamnestisch war zu erfahren, dass der 36-jährige Patiente seit 45 min über zunehmende retrosternale Schmerzen geklagt und sich aufgrund der Symptomatik in sein Zimmer im Hause der Eltern zurückgezogen hatte. Dieses thorakale Druckgefühl bestand rezidivierend wohl schon seit mehreren Jahren, wobei die Intensität am Einsatztag zum ersten Mal nicht nachgelassen hatte.

Gegen 12.40 Uhr fand ihn seine Mutter *schnarchend* und zyanotisch auf. Der zu Hilfe gerufene Vater begann sofort mit der *Laienreanimation*, während die Mutter den Notruf absetzte.

Tab. 1 Einsatzrelevante Zeiten (Datenquelle: NADOK®)

Alarmierung	12:45 Uhr
Ausrücken	12:46 Uhr
Ankunft am Einsatzort NEF	12:55 Uhr
Ankunft am Einsatzort RTW	12:57 Uhr
1. Defibrillation	12:56 Uhr
Beginn Autopuls Reanimation	12:56 Uhr
Intubation	12:57 Uhr
1. Adrenalingabe	13:00 Uhr
ROSC	13:03 Uhr
Transportbeginn	13:29 Uhr
Ankunft im Krankenhaus	13:47 Uhr

NEF Notarzteinsatzfahrzeug, **RTW** Rettungswagen, **ROSC** „return of spontaneous circulation".

Der Notarzt traf 10 min nach Alarmierung am etwa 10 km entfernten Einsatzort ein.

Die Eltern berichteten auf Nachfrage von einem Hinterwandinfarkt, den ihr Sohn vor unbekannter Zeit erlitten hatte und der zufällig bei einem Krankenhausaufenthalt im Jahr 2001 im EKG entdeckt wurde. Es bestand überdies ein Mischkonsum von Nikotin (19"packyears"), Alkohol und Amphetaminen.

Klinische Versorgung

Bei Übergabe an die internistische Intensivstation war der Patient mit einem Atemminutenvolumen von 7 l/min, mit 100% Sauerstoff und einem „positive endexspiratory pressure" (PEEP) von 5 cm H_2O, unter Kontrolle der exspiratorischen CO_2-Konzentration, beatmet.

Fallbeispiele:

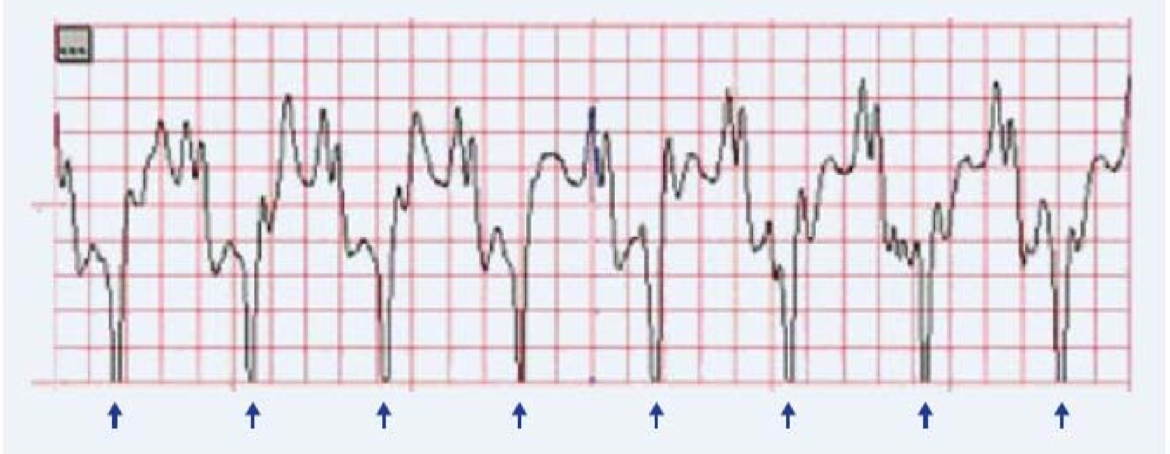


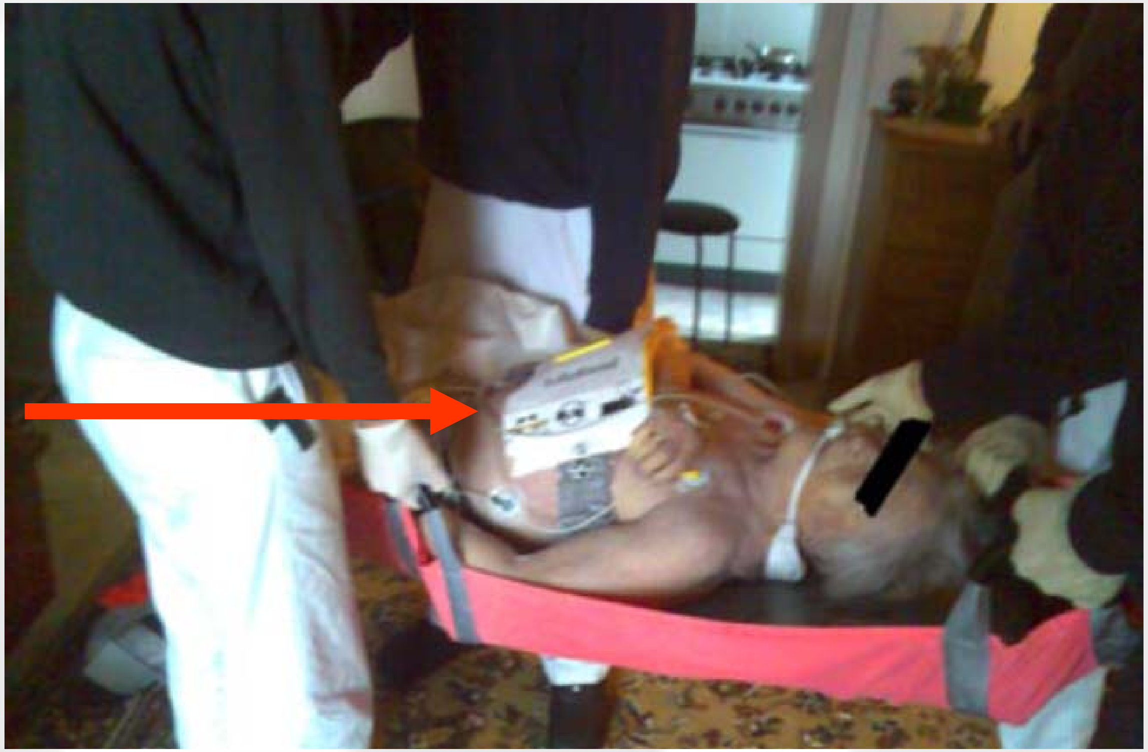
Abb. 2 ▲ Typische elektronische EKG-Aufzeichnung während des Auto-Pulse-Einsatzes mit einem Monitor (Zoll, M-Serie). Beachte den regelmäßigen Rhythmus *(blaue Pfeile)* der EKG-Artefakte, hervorgerufen durch die Thoraxkompressionen. (Kästchen 0,2s*0,5 mV, EKG-Ableitung über Defibrillationselektroden)

Bei beobachtetem Herz-Kreislauf-Stillstand mit unverzüglicher Laienreanimation und weiterhin fortbestehendem Kammerflimmern wurde um 15.05 Uhr, d. h. nach 18 min frustraner CPR, durch den Notarzt die Entscheidung getroffen, den Patienten unter Fortführung der Reanimationsmaßnahmen in ein nahe gelegenes Krankenhaus mit Herzkatheterlabor zur interventionellen Koronartherapie zu transportieren. Aufgrund des kurzen Transportweges im städtischen Bereich wurde von einer präklinischen Lysetherapie abgesehen

Schewe, Anaesthesist 2008

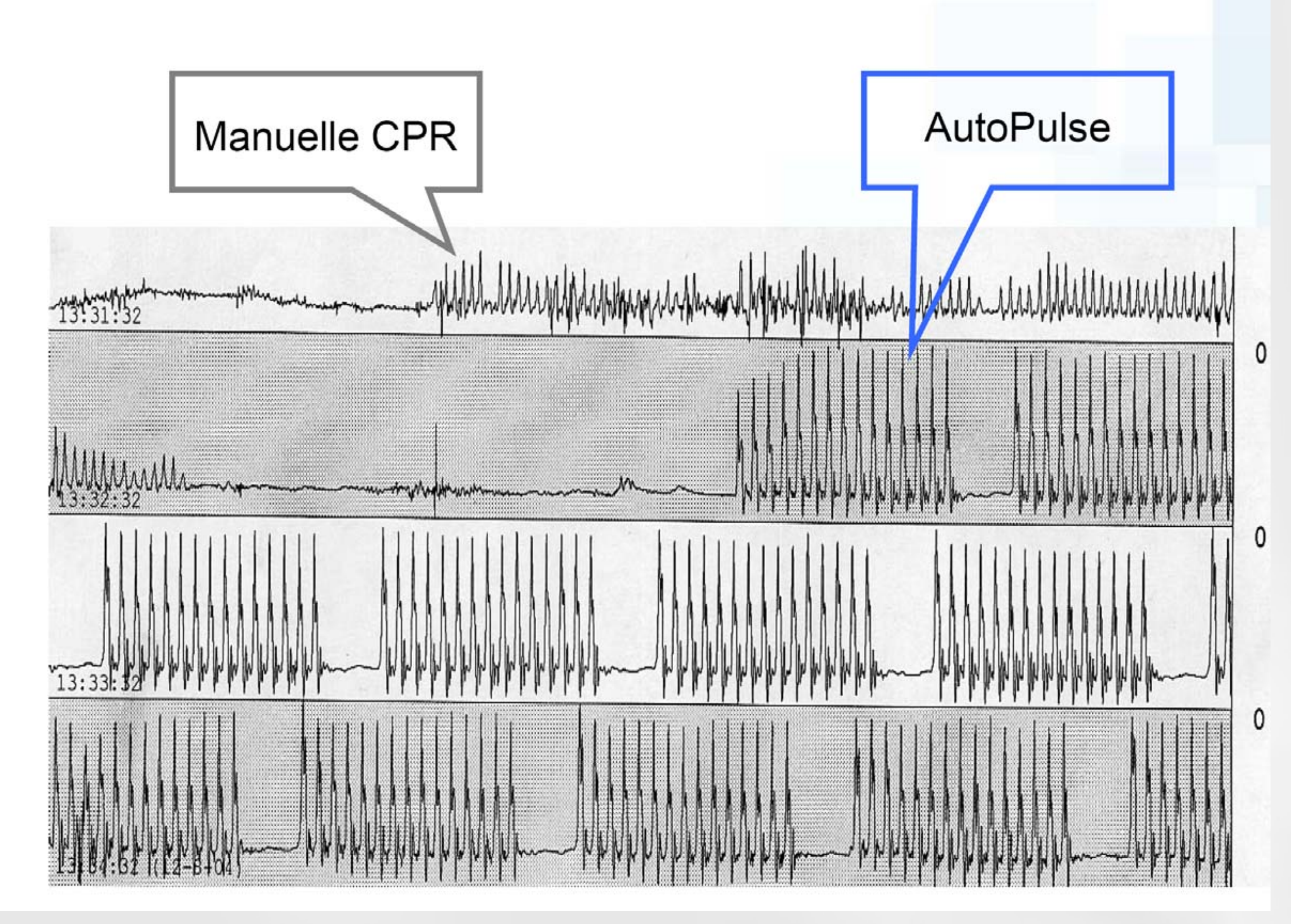
Fallbeispiele:

Cave: Verrutschen!



Der Transport zum Rettungswagen erfolgte mit einem unter den AutoPulse gelegten Rettungstragetuch unter Fortführung der kontinuierlichen Thoraxkompressionen.

AutoPulse CPR während PTCA:



Fallbeispiele:

Die durchgeführte PCI hatte ein gutes funktionelles Primärergebnis. Im Anschluss an die PCI war der Patient zunächst noch katecholaminpflichtig… Der Patient konnte am vierten Tag auf der Intensivstation extubiert werden… kurzzeitiges akutes Nierenversagen mit notwendiger Hämofiltration … ausgeprägten hirnorganischen Psychosyndroms … Der Patient konnte nach insgesamt 17 Tagen stationären Aufenthalts ohne neurologische Schäden in eine Anschlussheilmaßnahme entlassen werden.

Schewe, Anaesthesist 2008

The Impact of a New CPR Assist Device on Rate of Return of Spontaneous Circulation in Out-of-hospital Cardiac Arrest

Michael Casner, MD, David Andersen, BS, NREMT-P, S. Marshal Isaacs, MD

TABLE 4. Matched Cases: Number and Percentage of Patients with Sustained Return of Spontaneous Circulation (ROSC)

	Total	Sustained ROSC	No Sustained ROSC	% Sustained ROSC	p
All patients					
Manual CPR only	93	27	66	29	0.003
A-CPR	69	27	42	39	
Asystole/agonal total					
Manual CPR only	49	11	38	22	0.008
A-CPR	35	13	22	37	
PEA total					
Manual CPR only	22	5	17	23	0.079
A-CPR	16	6	10	38	
VF/VT total					
Manual CPR only	22	11	11	50	0.340
A-CPR	18	8	10	44	

Sustained ROSC = return of spontaneous circulation sustained to hospital arrival; PEA = pulseless electrical activity; VF = ventricular fibrillation; VT = pulseless ventricular tachycardia; p = probability of sustained versus no sustained ROSC; CPR = cardiopulmonary resuscitation; A-CPR = CPR with the AutoPulse assist device.

Casner M. et al, Preh Emerg Care, 2005

RESUSCITATION 2009 CO

ORIGINAL CONTRIBUTION

Use of an Automated, Load-Distributing Band Chest Compression Device for Out-of-Hospital Cardiac Arrest Resuscitation

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Context Only 1% to 8% of adults with out-of-hospital cardiac arrest survive to hospital discharge.

Objective To compare resuscitation outcomes before and after an urban emergency medical services (EMS) system switched from manual cardiopulmonary resuscitation (CPR) to load-distributing band (LDB) CPR.

Design, Setting, and Patients A phased, observational cohort evaluation with intention-to-treat analysis of 783 adults with out-of-hospital, nontraumatic cardiac arrest. A total of 499 patients were included in the manual CPR phase (January 1, 2001, to March 31, 2003) and 284 patients in the LDB-CPR phase (December 20, 2003, to March 31, 2005); of these patients, the LDB device was applied in 210 patients.

Intervention Urban EMS system change from manual CPR to LDB-CPR.

Main Outcome Measures Return of spontaneous circulation (ROSC), with secondary outcome measures of survival to hospital admission and hospital discharge, and neurological outcome at discharge.

Results Patients in the manual CPR and LDB-CPR phases were comparable except for a faster response time interval (mean difference, 26 seconds) and more EMS-witnessed arrests (18.7% vs 12.6%) with LDB. Rates for ROSC and survival were increased with LDB-CPR compared with manual CPR (for ROSC, 34.5%; 95% confidence interval [CI], 29.2%-40.3% vs 20.2%; 95% CI, 16.9%-24.0%; adjusted odds ratio [OR], 1.94; 95% CI, 1.38-2.72; for survival to hospital admission, 20.9%; 95% CI, 16.6%-26.1% vs 11.1%; 95% CI, 8.6%-14.2%; adjusted OR, 1.88; 95% CI, 1.23-2.86; and for survival to hospital discharge, 9.7%; 95% CI, 6.7%-13.8% vs 2.9%; 95% CI, 1.7%-4.8%; adjusted OR, 2.27; 95% CI, 1.11-4.77). In secondary analysis of the 210 patients in whom the LDB device was applied, 38 patients (18.1%) survived to hospital admission (95% CI, 13.4%-23.9%) and 12 patients (5.7%) survived to hospital discharge (95% CI, 3.0%-9.3%). Among patients in the manual CPR and LDB-CPR groups who survived to hospital discharge, there was no significant difference between groups in Cerebral Performance Category ($P=.36$) or Overall Performance Category ($P=.40$). The number needed to treat for the adjusted outcome survival to discharge was 15 (95% CI, 9-33).

Conclusion Compared with resuscitation using manual CPR, a resuscitation strategy using LDB-CPR on EMS ambulances is associated with improved survival to hospital discharge in adults with out-of-hospital nontraumatic cardiac arrest.

JAMA. 2006;295:2629-2637 www.jama.com

Approximately 400 to 460 000 individuals die every year from out-of-hospital cardiac arrest (OHCA),[1] representing approximately one third of all cardiovascular deaths[2] in the United States. Only 1% to 8% of individuals with OHCA survive to hospital discharge.[3-6] Patients who have ventricular fibrillation for less than 3 to 4 minutes (the electrical phase of cardiac arrest)[7] fare relatively well if rescuers arrive quickly and provide prompt defibrillation.[8-11]

However, once ventricular fibrillation has been present longer, the myocardium becomes depleted of adenosine triphosphate and defibrillation usually results in conversion to asystole or a pulseless electrical rhythm.[7] Several studies suggest that a brief period of cardiopulmonary resuscitation

See also pp 2620 and 2661.

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ORIGINAL CONTRIBUTION

Manual Chest Compression vs Use of an Automated Chest Compression Device During Resuscitation Following Out-of-Hospital Cardiac Arrest

A Randomized Trial

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Lynn J. White, MS
Stephen Yahn, EMT-P
James Husar, EMT-P
Mary F. Morris
Leonard A. Cobb, MD

Context High-quality cardiopulmonary resuscitation (CPR) may improve both cardiac and brain resuscitation following cardiac arrest. Compared with manual chest compression, an automated load-distributing band (LDB) chest compression device produces greater blood flow to vital organs and may improve resuscitation outcomes.

Objective To compare resuscitation outcomes following out-of-hospital cardiac arrest when an automated LDB-CPR device was added to standard emergency medical services (EMS) care with manual CPR.

Design, Setting, and Patients Multicenter, randomized trial of patients experiencing out-of-hospital cardiac arrest in the United States and Canada. The a priori primary population was patients with cardiac arrest that was presumed to be of cardiac origin and that had occurred prior to the arrival of EMS personnel. Initial study enrollment varied by site, ranging from late July to mid November 2004; all sites halted study enrollment on March 31, 2005.

Intervention Standard EMS care for cardiac arrest with an LDB-CPR device (n=554) or manual CPR (n=517).

Main Outcome Measures The primary end point was survival to 4 hours after the 911 call. Secondary end points were survival to hospital discharge and neurological status among survivors.

Results Following the first planned interim monitoring conducted by an independent data and safety monitoring board, study enrollment was terminated. No difference existed in the primary end point of survival to 4 hours between the manual CPR group and the LDB-CPR group overall (N=1071; 29.5% vs 28.5%; $P=.74$) or among the primary study population (n=767; 24.7% vs 26.4%, respectively; $P=.62$). However, among the primary population, survival to hospital discharge was 9.9% in the manual CPR group and 5.8% in the LDB-CPR group ($P=.06$, adjusted for covariates and clustering). A cerebral performance category of 1 or 2 at hospital discharge was recorded in 7.5% of patients in the manual CPR group and in 3.1% of the LDB-CPR group ($P=.006$).

Conclusions Use of an automated LDB-CPR device as implemented in this study was associated with worse neurological outcomes and a trend toward worse survival than manual CPR. Device design or implementation strategies require further evaluation.

Trial Registration clinicaltrials.gov Identifier: NCT00120965

JAMA. 2006;295:2620-2628 www.jama.com

Out-of-hospital cardiac arrest claims hundreds of thousands of lives annually in North America. Successful resuscitation depends on a coordinated set of actions including early cardiopulmonary resuscitation (CPR). High-quality CPR may be important for both cardiac and brain resuscitation.[1-3] In animal investigations, fewer interruptions of CPR before and after defibrillation have improved cardiac and neurological outcomes.[4-7] The order of resuscitation interventions may also be important, eg, survival may be improved by performing CPR by emergency medical services (EMS) personnel prior to defibrillation.[8,9]

See also pp 2629 and 2661.

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Mechanische CPR-Systeme

aerzteblatt.de 14. Juni 2006

Medizin

Reanimation: Brustgurt zur Thoraxkompression im Test

Seattle/Richmond - Ein auch in Deutschland angebotenes Kompressionsband (load-distributing band, LDB) soll Notärzten die schwierige und kräftezehrende Herzdruckmassage abnehmen. Zwei im amerikanischen Ärzteblatt (JAMA) veröffentlichte Studien kommen jedoch zu sehr unterschiedlichen Ergebnissen.

„Kümmern Sie sich um Ihren Patienten. AutoPulse® kümmert sich um sein Herz", bewirbt der Hersteller sein Produkt im Internet. Das Gerät zur „automatisierten" Herzdruckmassage besteht aus einer starren Rückwand, auf die der Patient gelegt wird. Mit wenigen Handgriffen kann ein flexibles Band über die Brust gespannt werden, das sich dann periodisch zusammenzieht und auf diese Weise den Brustkorb komprimiert. Das Gerät kann bis zu 80 Kompressionen pro Minute durchführen, wobei ein Mikroprozessor automatisch die Kraft berechnet, die notwendig ist, um die Brustwand um 20 Prozent zusammenzupressen.

Das Gerät hat alle technischen Prüfungen bestanden. Auch die strengen Auflagen der FDA erfüllt es, doch ganz so einfach, wie die Produktbroschüre dies suggeriert, scheint die Anwendung nicht zu sein. In den USA musste im März letzten Jahres eine randomisierte Multicenterstudie gestoppt werden. Wie Al Hallstrom von der Universität von Washington in Seattle und Mitarbeiter berichten, hatte das LDB den primären Endpunkt, ein Überleben in den ersten 4 Stunden, nicht verbessert (JAMA 2006; 295: 2620-2628). Zudem hatte AutoPulse in einem zentralen sekundären Endpunkt noch deutlich schlechter abgeschnitten: Nur 5,8 Prozent der mit Unterstützung des LBD reanimierten Patienten verließ die Klinik lebend, während es nach manueller Herzmassage 9,9 Prozent waren. Außerdem war die Rate der Patienten, die mit neurologischen Folgeschäden die Klinik verließen, erhöht (7,5 Prozent versus 3,1 Prozent bei manueller Herzdruckmassage).

Ganz anders war das Ergebnis einer Studie, über die Marcus Eng Hock Ong von der Universität in Richmond/Virginia und Mitarbeiter berichten (JAMA 2006; 295: 2629-2637). Hier verbesserte AutoPulse den Anteil der Patienten, der die Klinik lebend verließ, von 2,9 auf 9,7 Prozent. Dies ergibt eine Number Needed to Treat von nur 15. So viele (oder wenige) Patienten müssen mit AutoPulse reanimiert werden, um einem Patienten zusätzlich das Leben zu retten. Die Gruppe um Eng Hock Ong hat zahlreiche Subgruppen-Analysen durchgeführt. Aus ihnen geht unter anderem hervor, dass die besten Chancen bestehen, wenn das Rettungsteam innerhalb der ersten 8 Minuten nach dem Notruf eintrifft.

Doch die Diskrepanzen zur anderen Studie lassen sich so nicht erklären. Wie ein und dasselbe Gerät in zwei Studien zu völlig unterschiedlichen Ergebnissen führt, ist auch den Editorialisten Roger Lewis und James Niemann von der Harbor-Universität in Los Angeles ein Rätsel. Sie fordern die Ärzte zu einer gezielten Selektion der Patienten auf, bei denen das Gerät zum Einsatz kommen sollte, vermögen diese Gruppe aber nicht genau zu beschreiben. Weitere Analysen müssen nun zeigen, worauf die Unterschiede in den Studien beruhen. Zu prüfen wäre wohl auch, ob der Umgang mit dem Gerät wirklich so einfach ist, wie die Broschüre suggeriert. Vielleicht reicht es auch nicht aus, die Sorge um die Herzfunktion des Patienten einfach an das LBS zu delegieren. /rme

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EDITORIALS

Editorials represent the opinions of the authors and *JAMA* and not those of the American Medical Association.

Manual vs Device-Assisted CPR

Reconciling Apparently Contradictory Results

Roger J. Lewis, MD, PhD
James T. Niemann, MD

Results	Hallstrom et al., JAMA, 2006	Ong et al., JAMA, 2006
AutoPulse	n=394	n=499
manual	n=373	n=278
Primary outcome	Survival to 4 h	ROSC
AutoPulse	26.4%	34.5%
manual	24.7%	20.2%
Secondary outcomes	Survival to hospital discharge	Survival to hospital discharge
AutoPulse	5.8%	9,7%
manual	9.9%	2,9%
Secondary outcomes	Good neurological outcome (CPC 1 or CPC 2)	Good neurological outcome (CPC 1 or CPC 2)
AutoPulse	3.0%	9.4%
manual	7.5%	1,6%

Lewis, JAMA 2006

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Editorial

Mechanical chest compression devices—Will we ever get the evidence?

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5 August 2009

CIRC TRIAL (http://www.circtrial.com/)

CIRC

AutoPulse® Clinical Trial

AutoPulse®, an FDA-cleared automated chest compression system being used globally for more than four years

CIRC TRIAL INFORMATION

- > Home
- > Study Overview
- > What is CIRC?
- > What is AutoPulse?
- > Patient Enrollment
- > Communities
- > Research Team

CONTACT US

WELCOME TO THE CIRC TRIAL

For forty years, giving chest compressions and ventilations with a technique called Cardiopulmonary Resuscitation (CPR) has been the standard of care for victims of cardiac arrest. The CIRC Trial will test the effectiveness of an automated chest compression assist device by comparing its performance in combination with manual chest compressions to manual chest compressions alone. The FDA-cleared device is called the AutoPulse® and is manufactured by ZOLL Medical Corporation, a leader in the field of resuscitation and the sponsor of this trial. Unlike most clinical trials that are designed to test experimental products, CIRC is a study that compares two accepted forms of CPR treatment: manual chest compressions and AutoPulse-Integrated chest compressions.

Unfortunately, despite CPR technique refinement, the development of support devices such as automatic external defibrillators (AEDs), and intensive training/retraining programs, the sudden cardiac arrest survival rate has remained unacceptably low. Improvements are clearly needed.

Advanced life support performance with manual and mechanical chest compressions in a randomized, multicentre manikin study☆

Oystein Tomte[a,b,*], Kjetil Sunde[a,b], Tonje Lorem[a,c], Bjorn Auestad[d], Chris Souders[e,f], Jeff Jensen[g], Lars Wik[a,c]

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[d] Department of Mathematics and Natural Sciences, University of Stavanger, Norway
[e] Houston Fire Department, Houston, TX, USA
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[g] ZOLL Medical Corporation, MA, USA

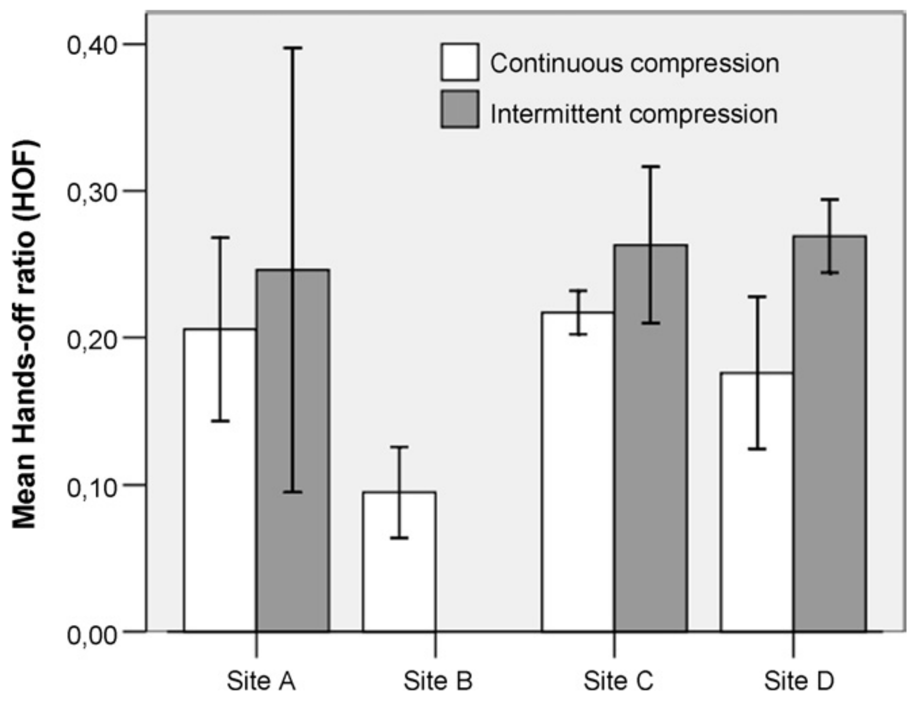

Fig. 2. Hands-off fraction (HOF) without (white) and with (grey) pauses for ventilations in 30/2 compression to ventilation cycles following intubation. Such pauses occurred in 31% (site A), 0% (site B), 18% (site C) and 74% (site D) of the scenarios.

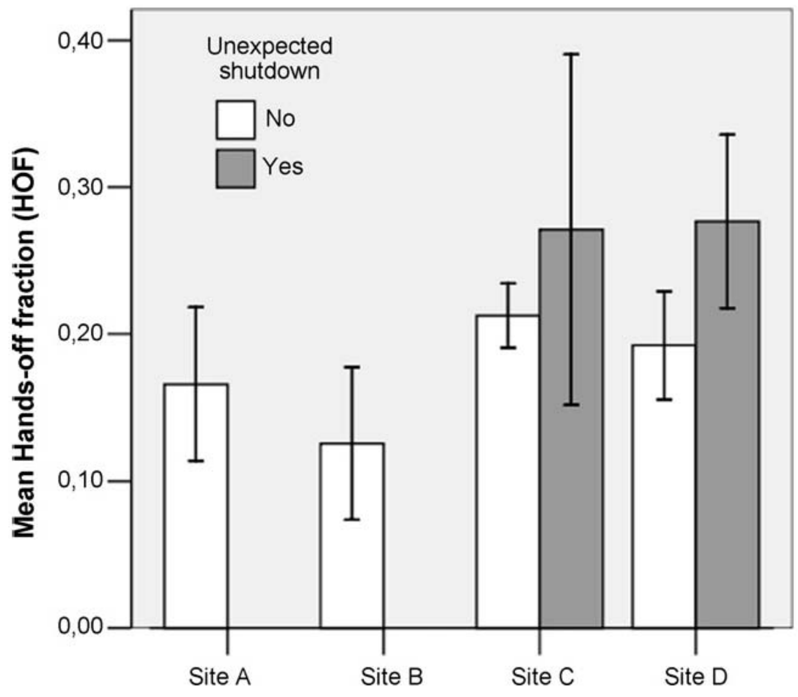

Fig. 3. Hands-off fraction (HOF) for LDB-CPR scenarios with (grey) and without (white) unexpected LDB device shutdown during CPR. Unintentional stops occurred only at sites C (24%) and D (25%).

O. Tomte et al. / Resuscitation 80 (2009) 1152–1157

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AutoPulse in Bonn, Ulm, Göppingen

AutoPulse® vs. manuel CPR

- 150 patients in pilot-study
- RCT was started at 1. March 2008 in Bonn
- Ulm and Göppingen will start with skill and in field training in 2009
- Primary endpoint: Survival to hospital admission
- Secondary endpoint: Survival 30 day and 6 month and neurological recovery (CPC)
- Power analysis: 500 patients for primary endpoint

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www.reanimationsregister.de

Statistik präklinische Reanimationen 05.2005-10.2009

Typ AutoCPR	Standort [n]	Standort [%]	Gesamtdaten [n]	Gesamtdaten [%]
keine Angabe	0 / 376	0,00%	1159 / 4415	26,25%
Lucas	0 / 376	0,00%	248 / 4415	5,62%
AutoPulse	0 / 376	0,00%	194 / 4415	4,39%
nicht bekannt	0 / 376	0,00%	3 / 4415	0,07%

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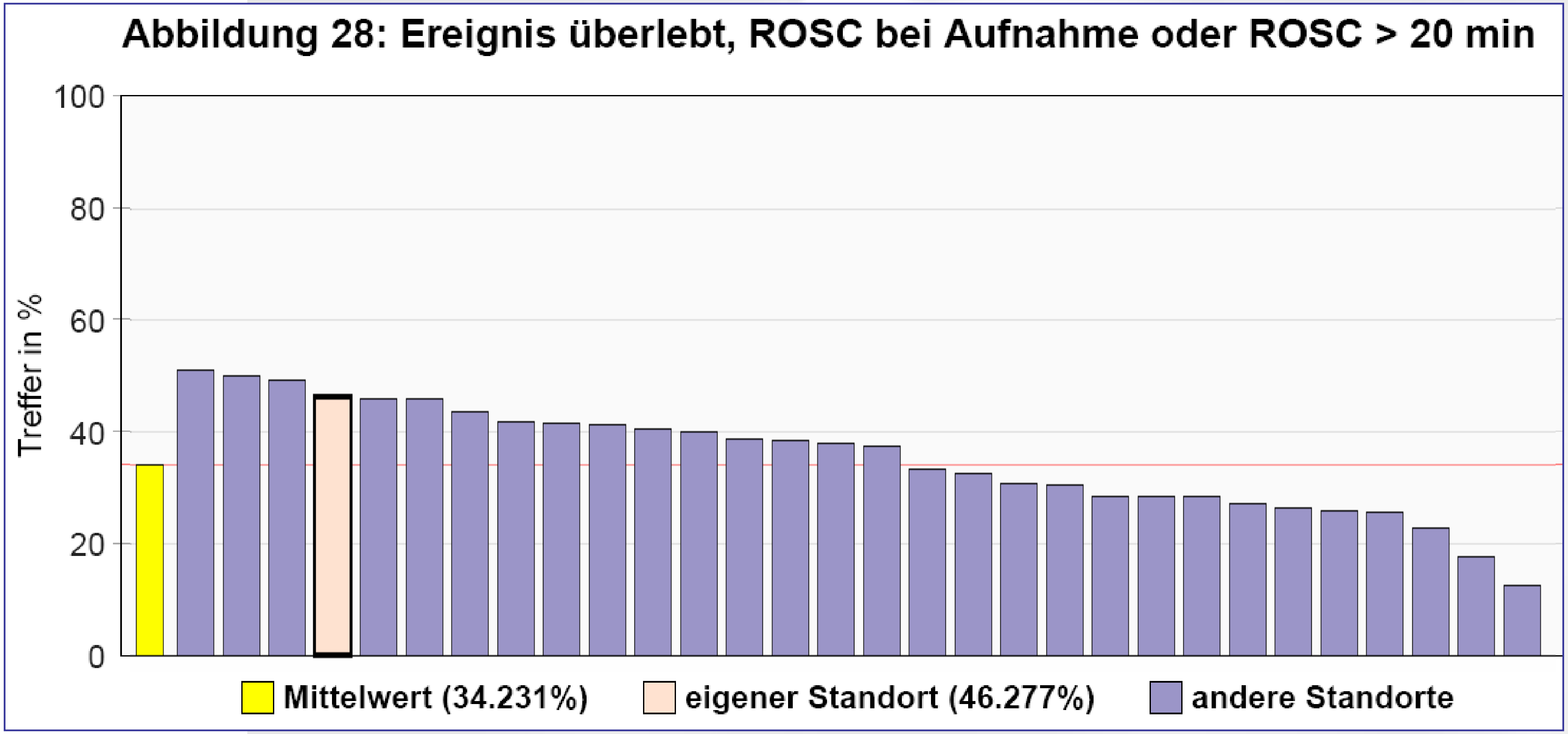
www.reanimationsregister.de

Statistik präklinische Reanimationen 05.2005-10.2009



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Zusammenfassung

1. Basismaßnahmen sind Grundlage der CPR
2. Selbst Profis reanimieren nicht optimal
3. Basismaßnahmen können durch Hilfsmittel optimiert werden
4. LUCAS und AutoPulse standardisieren CPR Qualität und ermöglichen CPR während Transportes und PTCA

2005

5. ACD + ITV → IIa Empfehlung
6. LUCAS → unbestimmt
7. AutoPulse → IIb Empfehlung
8. CPR-Register, von den Besten lernen: Gutes Outcome ohne mechanische CPR-Systeme möglich, intensives Training, Feedback, QM erforderlich
9. Derzeit keine generelle Empfehlung, weitere Studien notwendig!


Danke für Ihre
Aufmerksamkeit!